

AVIATION WEEK

NOV. 28, 1955

50 CENTS

A MCGRAW-HILL PUBLICATION



TARGET: SUBMERGED SUB The protecting cloaks of night, foul weather, and ocean are stripped from a submarine by the detection gear and skill of an S2F Navy crew. Pinpointed, the sub is sent to a point of no return—the bottom of the sea. All this equipment required a two plane hunter-killer team until Grumman packaged it into a single aircraft. Grumman S2F's are now operational with the Navy.

GRUMMAN AIRCRAFT ENGINEERING CORPORATION BETHPAGE • LONG ISLAND • NEW YORK

Designers and builders also of the supersonic Tiger, Cougar II, Albatross amphibian, metal boats, and Aerobilt truck bodies

First in Constant Speed Drives ..



NEW CONTROL
provides

400± 1/10 cps

Load division within 1 kw

is

rugged, reliable,

smaller, lighter



New sundstrand drive control just developed for the government and Sundstrand Aerospace's Constant Speed Drive works under substantial advance in aircraft constant frequency electrical systems. Besides two Sundstrand controls, rugged and reliable, the new control has no moving parts, is unaffected by temperature or oil contamination. Applied to the typical generator, Sundstrand even gives the generator faster than normal response, makes master speed adjustment. These characteristics, plus a new frequency and load controller, make possible average steady state bus frequency of 400± 1/10 cps, load division between parallel alternators within 1 kw, and greatly enhanced reliability. All of these benefits are derived from a controlling system considerably smaller and lighter than previous systems. Find out how a Sundstrand drive control system can help you!

New horizons...
are opening to design engineers, through co-operation between engine and airframe manufacturers and Sundstrand. With this new concept in electrical systems, expect remarkable advances in operation and performance of tomorrow's aircraft.

SUNDSTRAND AVIATION

Division of Sundstrand Mechanical and Company 5000 FORD ROAD, VAN NUYS, CALIFORNIA 91411

CONSTANT SPEED DRIVES • AIRCRAFT ACCESSORIES

RESEARCH KEYS

B.F. Goodrich

FIRST IN RUBBER



More punch for fighters, more payload for airliners with B. F. Goodrich Tubeless Tires

Two of the latest models in both military and civilian aircraft are now equipped with B. F. Goodrich Tubeless Tires. The Navy's newest jet fighter, Chance Vought Corsair, which flies at supersonic speeds at level flight, is equipped with B. F. Goodrich Tubeless to help it withstand the punishment of high speed take-offs and landings on carrier flight decks. And a Pan American World Airways Clipper® now uses BFG Tubeless in overseas service.

The big reason more pay load B. F. Goodrich Tubeless Tires are worth. Airliners are saving as much as 125 pounds, one carry that much more pay load. Fighters can add more fighting

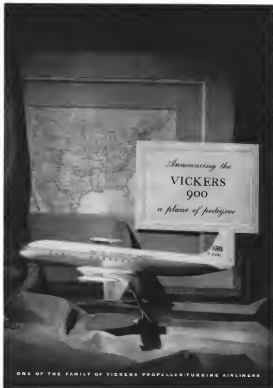
equipment. Both save time and money in overhauling and maintenance. Instead of a tire and axle, there's only the tire to purchase and stock — only the tire to mount and service.

The use of B. F. Goodrich Tubeless in a growing proportion of the army forces, likewise in the BFG Tubeless Tires, is another sign as well as assurance. Among the reasons that make the BFG Tubeless Tire safer is the special patented safety liner, developed first by B. F. Goodrich. It eliminates the conventional inner tube, means correct inflation pressure much longer. There's no hole in there or leak. No hole to burst or shift during take-off or landing.

Both B. F. Goodrich high pressure Tubeless tires for fighters and commercial type Tubeless for airliners are in full production. All are examples of B. F. Goodrich pioneering and leadership in Tubeless — in the air and on the ground. The B. F. Goodrich Company, Tire & Equipment Division, Akron, Ohio.

B.F. Goodrich
TIRE PRODUCTS

Tires, wheels, brakes • On line • Road & off-road • Light duty • Heavy • Pressure testing • Repair • Retreading • Service • Spare tires • Spare wheels



ONE OF THE FAMILY OF VICKERS PROPELLER-TURBINE AIRLINERS

NEWS DIGEST



The Velvet Glove

The first polished portion of the Velvet Glove Canadian air-to-air missile is shown above. The expensive missile, assembled by Canadair, has been successfully test fired from both F4U Sabres and CF-105s (AW Nov. 18, p. 7). Performance details are classified.

Domestic

Bombardier guided missile will be produced at Boeing Airplane Co.'s Wichita, Kan., plant. Defense Department used the decision followed its directive on industrial dispersion (see p. 18). Experimental and developmental engineering will continue at Seattle, Wash.

Dr. Clifford C. Furness, 35, Chairman of the University of Buffalo, has been appointed Assistant Secretary of Defense for Research and Development (AW Oct. 26, p. 7). He fills the post vacated by Donald A. Quarles when he was named Secretary of the Air Force. Dr. Furness, a chemical engineer, is a former director of the General Aviation test laboratory and director of research for Curtiss-Wright at Buffalo.

U. S. Army plans to equip major German (West) and Army installations with Nike surface-to-air missile units.

Ryan demonstrated Co. Latest Air Force contract "will ensure production" of its Q-1A Firebee target missile "well into 1958." The contract, plus a previously announced \$3.5 million order, nearly met the USAF's present schedule for the Firebee, but Ryan is negotiating "additional quantity orders."

Panache Helicopter Corp. has been awarded a contract for 105 EH-21 Wood Horse helicopters for the U. S. Army. The new order increases the company's

backlog to \$140 million as compared with \$100 million at the end of 1954, according to Don R. Berlin, Panache's president.

Hamilton Standard Division of United Aircraft Corp. plans to construct an additional 310,000 sq ft of manufacturing space and 40,000 sq ft of office space at its Windsor Locks, Conn., plant. The present floor area (approximately 3,000,000 sq. ft.) was designed to accommodate 3,000 employees. Hamilton now has 7,000 and plans to add another 500 production employees and 150 engineers within the immediate future.

Pan American World Airways, Inc. flew a total of 394,105,000 passenger-miles and 13,496,000 plane-miles during the third quarter of the year. Figures for the same period of 1954: 711,563,800 passenger-miles and 19,465,476 plane-miles. Third year's second-quarter figures were 742,112,000 and 21,990,431, respectively.

Financial

General Dynamics Corp. estimated its backlog of unfilled orders as of Sept. 30 at \$3,415 million, the highest in the corporation's peacetime history. Net sales for the nine-month period ending on that date totaled \$596,151,326 and net income (after U. S. and Canadian taxes), \$11,756,390. Net sales for the same period of 1954 were \$477,813,431, net income, \$14,161,035.

Chrysler-Vought Aircraft, Inc., declared a dividend of 40 cents a share payable Dec. 15 to common stockholders of record Dec. 1.

National Airlines' operating revenues reached a new high of \$33,171,476 during the 12-month period ending Sept. 30. It was the first time they had exceeded the \$50 million mark. NAL also reported that the three-month period ending Sept. '56 was the most profitable first quarter in its history with net earnings at \$108,394 (40 cents a share).

International

British European Airways scheduled plans for Britain's first inter-city high speed jet service, London-Birmingham-Leicester-Nottingham, with service to begin in the spring.

The De Havilland Republic will construct a \$9 million airport capable of handling jet transports at Puerto Canadair, 35 miles east of Ciudad Trujillo. Performance plans for the airport, technically scheduled for completion sometime in 1958, were given by Dr. Porras & Serra, Panamericano, Managua.

Reed Aviation air fleet chose the DH-115 two-seat Tutor and a dual-control version of the English Electric Canberra as the basic planes for its jet training program. Orders were placed for approximately 200 Tutor and nine dual-control Canberras.

First light twin to use supercharged engines has "Hi-Fatigue" Cable installations!



New Aero Commander 680 Super, by Aero Design and Engineering Company. This new model plane carries 6-7 passengers, cruise at 230 mph.

NEW AERO COMMANDER 680 SUPER!

The Aero Commander 680 Super is the first light twin-engine executive plane to offer supercharged performance. The new model has a useful load capacity of 2,700 lbs., a single-engine ceiling of 15,000 feet, a cruising speed of 230 mph., and a one-stop, coast-to-coast range. The Aero Commander 680 is equipped with Macwhyte "Hi-Fatigue" control cable. "Hi-Fatigue" control cable is widely used by leading manufacturers. A complete line of sizes and types is supplied in Galvanized, Tinneled,



Interior view showing "Hi-Fatigue" control cable installation in the Aero Commander 680.

and Stainless Steel, "Safe-Lock" Terminals for swaging, may be purchased loose or attached. Macwhyte Aircraft Products meet the requirements of aircraft manufacturers, airlines, and military specifications.

Send for illustrated Catalog. A for detailed information on Cable, Terminals, and Accessories.

"Hi-Fatigue"

is a registered trademark.

MACWHYTE
CABLE • TERMINALS • ASSEMBLIES • TIE-RODS

20040 Peachtree Corners, Georgia
Atlanta, Georgia
Baltimore, Maryland
Boston, Massachusetts
Chicago, Illinois
Dallas, Texas
Denver, Colorado
Detroit, Michigan
Houston, Texas
Los Angeles, California
Miami, Florida
Minneapolis, Minnesota
New York, New York
Philadelphia, Pennsylvania
Portland, Oregon
San Francisco, California
Seattle, Washington
Tampa, Florida
Washington, D.C.

NEW YORK
New York 4, 20 West St.
Philadelphia 20, 704 Second St.
Chicago 11, 120 N. Dearborn St.
St. Paul 14, 1205 Hampshire Ave.

PH. WASH. D.C.
Portland 5, 1401 N.W. 14th Ave.
Seattle 4, 47 Bridge St.
San Francisco 1, 100 King St.
Los Angeles 10, 2800 Normandie Blvd.



Washington Roundup

Copter Controversy

Back of the Army Air Force controversy over use of helicopters in Exercise Sagebrush (AW Nov. 23, p. 27) has a basis against one past doctrine. Sagebrush commander USAF Col. Gen. Otto P. Weyland, was overruled by USAF Secretary Donald Quarles when he tried to block Army's experiments with its new sky cavalry.

Quarles, in effect, said Weyland was right in his interpretation of the doctrine, but added that Army still should be allowed to test its new reconnaissance ideas. Sky Cav still may be very well within the Quarles' West agreement. Quarles emphasized that he acted in the Sagebrush case "without prejudice" to the basic issue of whether the Army should operate aircraft as a unit. His action followed discussions with Army Secretary Walter Brueker. Unexplained last week was Aviation Week's report that some Army officers at Sagebrush asked to fly in USAF helicopters on a short hop from England AFB, La. to Fort Polk, La., summer headquarters. Some were all the despite being invited by Air Colonel Army officers to discuss the matter. Following position of Brueker, who would not answer treatment's questions.

Renegotiation Future

Work for the Joint Congressional Committee on Federal Reserve. Tension is concerned to the next Congress sharp cutback of the Renegotiation Act power, perhaps termination when the law ends in 1956.

The committee has been meeting recently with industry and Government representatives to obtain their views on extending, modifying or terminating the act. Industry groups have been favorable in urging no end to renegotiation, but the views of individual companies on administration of the act probably will be tempered by the fact the renegotiation will apply to profits earned through 1956 even if the law expires.

Some Capitol Hill observers feel that renegotiation is being used as a political countermeasure to take the steam out of any Democratic competition of currently high defense profits.

The committee's report is due May 31, 1956.

More Permanent Airlines?

Congress is going to consider legislation directing Civil Aeronautics Board to grant more permanent certificates next session. Last session, legislation which permanent certificates for local service lines, despite Civil Aeronautics Board opposition Senate Commerce Committee's Chairman, Sen. Warren Magnuson (D-Wash.), already has announced in favor of an amendment to the local service legislation, which would direct a permanent route for Pacific Northwest Airlines which operates between Los Angeles and Seattle.

Congressional Investigations

Plans now are to open public hearings on two congressional investigations which underway for several months—before Congress meets in January. They are: • On the U.S. 48th Amendment agreement, which some U.S. airlines consider a "gimmie" to the Census Bureau. Led by the Senate Commerce Subcommittee headed by Sen. George Stassen (D-Fla.).

• On military aviation contracts and profits by the House Armed Services Subcommittee headed by Rep. Edward Herbert (D-La.). Aviation manufacturers will be scheduled first. The subcommittee also plans to call to testify engine companies, as well as aircraft subcontractors.

Rixley's New Campaign

Civil Aeronautics Board Chairman Ross Rixley can count on substantial support from Congress in his new line which advises investigations on U.S. lines negotiating bilateral air agreements with foreign governments (AW Nov. 21, p. 105). Airlines have repeatedly taken their complaint to congressional committees that bilateral was unfair without their having had an opportunity to express their opposition. Rixley will be very active in the new industry dispute talk policy. Rixley said, "I feel I think this campaign would be helpful for all."

Sabotage Committee

A thorough survey to develop preventive measures against a repetition of the recent crash of a United Air Lines DC-68 due to sabotage has been undertaken by a Civil Aeronautics Administration committee headed by Fred B. Lee, CAA Administrator. Lee established the committee after consultation with J. Edgar Hoover, Director of the Federal Bureau of Investigation, when it was determined the crash was caused by sabotage.

The committee is exploring how major airlines, their legislation, inspection, insurance, and aircraft manufacturers.

Airlines insurance companies have been asked to review the way their policies are written and make any changes necessary to insure the collection of insurance as an inducement to a solution.

Aircraft engineers are investigating methods for strengthening the structure of cargo bins with an eye to minimizing explosions. The idea of an extra air-cushioned suspension of passengers and their baggage already has been discussed but a mechanical inspection of baggage is still under consideration. The major problem confronting this method is that such devices would have to be made at all 514 air carrier airports and the cost could be prohibitive.

Capital Victory

Capitol Airlines has won its struggle with the Civil Aeronautics Board for additional baggage space at the CAA-operated Washington National Airport where Capital makes its headquarters.

Leon Rutherford, Under Secretary of Commerce for Transportation, ruled in favor of Capital which got a fourth baggage, now jointly occupied by CAA and the Coast Guard. Capital takes possession of the baggage in some planes as completed by CAA to move its aircraft in with the Air Force and the Coast Guard is a newly used terminal.

Rutherford's position is that the field must be considered primarily as a civil installation despite the fact CAA were it might be unworkable. Capital has agreed additional space for some time and the subject of its Vincent program completed the situation.

—Washington staff

Sagebrush Raises Serious Defense Questions

Port Polk, Ia.—Despite its success at the March 83 light jet buster in the spring days of Exercise Sagebrush may be overshadowed for many months before the Aggressor jet seems to have taken two days off duty from the public's view as serious questions about the performance of high speed defense equipment.

What is most important, from the military viewpoint here, is that the skepticism among local Sagebrushers was spread to Capitol Hill where the Defense Department budget will be examined next spring.

Some of the questions will be asked by the fast readers and evaluators of Exercise Sagebrush, Gen. Otto F. Weyland, command director, say it will be February or March before those papers are ready. That will be just in time for the first to come to the attention of congressional appropriations committees.

Meanwhile, the evidence here stands. There is more talk about Sagebrush in the nation of the U.S. than in any country from the wing, plane and tail.

The effort of a Shepherd newspaper has drawn a column to the issue that Sagebrush proves "warfare doctrine was not a foundation for complacency." He tries even to find a real enemy attack would not even come of the money's place position the role soon.

Finally, a St. Anne's newspaper has concluded that our nation is worried on a \$1 billion rate across that can be applied by the fact of a failure on money passing equipment.

Military men have pointed out that the air capabilities of Aggressor and Vandy (U.S.) forces in Sagebrush was not evenly balanced.

U.S. forces have slighter striking capability, Aggressor forces do not.

Aggressor has high altitude bombing capability, U.S. does not.

U.S. has two limited land supporting corps, Aggressor has only one.

At the beginning of the first tactical phase, Aggressor had numerical superiority in aerial jet aircraft.

U.S. forces have on all weather fighter capability.

Aggressor has no Member state capability.

needed to his general point from flying a performance.

"This plane goes too fast for me to see it right low level," he said. "You go for something, maybe like a low altitude and, low, then a jet one pass."

With the 8-25-1 model now retired, and come back at it again, but they have had no one to say it down a mile above to look for the thing again."

Yanovich believes radar would permit better objectives of the 8-25 mission range possibilities and still do a good job on the target while still in the beaching phase.

This also has endorsement from higher North. The Marine Corps has offered a personnel in USAF for the operation of a bombing and navigational radar to be carried along with SHORAN. Accuracy of the present equipment makes USAF reluctant to do it.

While SHORAN's range is limited, a computer operator can hit within a 400-ft circle from 4,000 ft.

A second Marine proposal, it was learned, is to use the capabilities of a radar, based in the 8-25 mission, to monitor the low speed, particularly when performing as one engine. Single-engine performance is reported good, but speed is critical.

Restricted to VFR Weather

Defenses have been more than for about a year and a half. Early versions are being returned to the factory for some modifications, mostly to improved engine.

Until this is done, the 8-25 is at restricted to VFR weather. The change involves a shroud ring on which the clearance has proven inadequate for 8-25 mission where the aircraft is sub-

jected to turbulent air, moisture and high clouds. Both changes in the clearance and the material from which the shroud ring is made are being considered as tests. The new ring material, some men say, will be "Styrofoam."

Another responsibility will be in the black paint that covers the fuselage. On the places at Randolph it was severely eroded from temperature changes. This came down on speed demands a critical point.

Mobile Photo Units

Reconnaissance pilots of the 35th Reconnaissance Group, 8-25, have reported over the B-25, mostly because of its speed. "I've seen Sagebrush," one man says, "a flight at about 8,500 miles over five targets, took four and a half hours. Some 15 to 20 pictures are taken at each target from above at an altitude of 20,000 ft."

The plans are made at Randolph in mobile air transportable trailer, brought here from Shaw AFB, S.C., in C-119s of the 13th AF. Two-day courses were given for the 8-25 pilots by Aggressor headquarters at England AFB, La., nearly 400 miles away.

It takes eight C-119s to move the reconnaissance outfit, partly because the trailer set out economical picking cost.

On the other hand, the dark room equipment is an up ready to act and finished prints are supplied quickly since they are unloaded at a day's notice.

Manufacturers crews on the 8-27 at Randolph AFB are expected to take care of their aircraft for 30 days. Major overhaul are done at a scheduled rate conference held at Riverton AFB, Ariz.

Cost checks have the command complaint that parts are in short supply, but there is no evidence of unusual cost increases for the system. They say the 8-27 is easy to work on.

Visible Experience

EC's constant emphasis on mobility and flexibility (AFW Nov. 22, p. 10) is not without its effect on the maintenance problem and it is true that Sagebrush is proving popular.

"Back at Shaw," one crew chief said, "the boys call too often for a specialist, usually because they're wrong. When they go out and do the job themselves. That's where we pick up a lot of maintenance capability on a moment's notice."

"What we lack in personnel, now we are making up to experience."

The same was told from out to prove the Marine Corps technical field representative, Frank Tins. He said from "his second around the

clock and is the biggest help we have to solve problems."

In that regard?

"It is where the outfit is situated," he replied.

Major side of the 88-75 in Sagebrush probably has been to bring in reports on damage inflicted by the battlefield. Post Operations Group, where Aggressor is commander, Maj. Gen. Edward J. Thibault has his headquarters, picks the targets and makes a damage damage assessment report.

The mission necessitates continuing reconnaissance over existing targets. New bombing runs are ordered to keep in many as possible of the U.S. air base out of commission.

Members of the 8-25 have a single response all the type used in Sagebrush and are started on missions in order of the priority given the target by JOC Back at Randolph, they get a list from the 8-25 and from the 8-25. The mission while the crew are briefed on the next targets. Some of the aircraft have aerial refueling capability, some do not.

Air Defense 'Sketchy'

Staying success of the 8-27 mission in Exercise Sagebrush set off a torrent of comment and discussion at member headquarters here.

Gen. Weyland and frankly that the background of Sagebrush's operations left the friendly forces "simply as an aid." This was inevitable if the co-operation was not to interfere with the steps in day-to-day, members of the Air Force Command.

However, Gen. Weyland added, "a good bit of action was involved now as in the limitations or vulnerability of the order winning system is involved."

"At an early time the equipment we have is susceptible to jamming."

Then he pointed out that as enemy attack on the United States, if it were not, would be a strategic threat at risk. First limitations would such an attempt to do this from his abilities.

"Because big battles have a long time on the clock."

Chess Game

Electronics experts observing the Sagebrush operation added that reconnaissance can be played on a continuous basis.

"It's a bit like a game of chess," one of them said, "only side adding a move and the opponent trying to find a new set."

It was made clear, as pointed by Gen. Weyland, that cutting U.S. equipment is limited by its vulnerability to jamming. The experts say it is possible to constantly shift frequencies to evade communications and even with the capability it being used. Some of

them will shift automatically to another frequency when jamming is started.

An additional factor is Sagebrush, Gen. Weyland said, was the obvious fact that Aggressor was well posted on the characteristics of U.S. radar, an advantage that would be lacking to a real enemy.

Another factor strongly favoring the

North American Has Record Year; Diversification Program Pays Off

Los Angeles—North American Aviation reports that the fiscal year ended Sept. 30, 1975, was the most successful in its history with a record profit of \$214.1 million.

The company's 1975 sales were \$1.4 billion and compared with \$1.4 billion in 1974 and \$1.37 in 1973.

Based Chairman J. H. Kneibler says these accomplishments for the 1975 fiscal year:

- Highest net income in history, \$18 million above last year.
- Highest sales in company history, with a total of more than \$1.4 billion.
- Physical and financial gains and gains in every major area, with a profit of \$214.1 million.
- Highest personnel employment, totaling 60,136. The wartime peak was 92,000 in October, 1945.

Heavy Backlog

The defense company gives its annual backlog as of Sept. 30 at \$1,175 million with another \$300 million still being negotiated. The report points that sales during the coming fiscal year will be approximately equal to those reported for the 1975 year.

Kneibler also reports that recent reorganization of the company, creating three new operating divisions, marks the start of a broad diversification program.

Collier Trophy Award

The Collier Trophy Award for the greatest achievement in aviation in 1974" will go to Robert F. Whitcomb, a research scientist for the National Advisory Committee for Aeronautics, for his discovery and experimental validation of the "area rule," a revolutionary concept in supersonic aircraft design that is increasing speeds of military aircraft by as much as 20% (AFW Sept. 12, p. 12).

"Whitcomb's area rule is a powerful, simple and useful method of reducing greatly the drag increase in wing drag associated with transonic flight," the citation says.

Whitcomb is assistant head of the 8th Aeronautical Research Division at NASA's Langley (Va.) Aeronautical Laboratory.

8-27 units in the Aggressor force was the majority of the opposing or power in Sagebrush.

While it was not emphasized by other agencies, for either the Army or Air Force, Gen. Thibault's 22nd (U.S.) Air Force did not have all weather fighter capability, being equipped with an squadron of F-4B's.

gram started ten years ago. These new divisions include:

• Aeronautics International—New engineering and manufacturing in the field of aircraft, power, industrial, medical and research research.

• Automation—Development and production in the field of automatic navigation and electro-mechanical control systems for engines and missiles and electronic.

• Rocketry—Development and manufacture of high thrust rocket engines for guided missiles and aircraft rockets. Kneibler and the reports report that the company's mission is to provide a strong basis for further expansion in those fields. All of them grew naturally from the company's interest in guided missiles.

After determining that atomic energy was not immediately feasible for missile propulsion, North American turned to jet engines for the main thrust. Atomic International Division was the result.

Rocketry

Background: Division grew from that same division. The company entered the rocket engine field when it determined that liquid propellant rockets would be most useful for missile propulsion. The Aerospace Division initially was focused on developing accurate guidance and control of NAVY long distance missiles, the Navaho.

All three divisions are indicative of North American's desire to expand its flight operations from short altitude maneuvers. The rapid growth of this division is one of the most rapid in the company's history.

The North American statement says that Aerospace Division reports that the major flight test program of the SM-64 Navaho missile has been moved to the Air Force Missile Test Center, Patrick AFB, Fla.

"The first program has been made in solving the engine structural and manufacturing problems involved in an advanced program of this kind," Kneibler reported. "New types of jet engines and new manufacturing techniques have been learned by experience."

order to achieve the rugged construction that will withstand the extreme crash loads of missile flight.

Kendelberger was first, in addition to supplying rocket engines for the SM-64, the Rocketdyne Division also is developing and manufacturing propulsion systems for other U. S. missile marine units.

Among these are the rocket engines for the Army's Redstone missile and the propulsion system for the Conquest sled. The division also is active in the field of search armament rockets. Kinetic-energy and several types of small liquid-propellant, as well as solid-propellant, rockets have been designed, developed and manufactured under experimental and service test programs.

Costs for units of the Rocketdyne Division has approximately doubled each year for the last three years. Total employment in this division went up during Fiscal 1955 from 1,900 to 4,412.

Manufacturing Divisions

The company gives the following report on its current manufacturing divisions for 1955:

• **Los Angeles—Completed** F-86F fighter interceptors and F-100A Super Sabre programs and began production of F-84K and F-100C. Resumed production of F-86F for M162 refueling Standard engineering on USAF Phase I contracts for a new fighter-bomber and a long range interceptor.

• **Columbus—Continued** manufacturing and delivery of F-1 Fury fighters throughout the year, with F-1s now in production build-up stage. Began production of F-105D and F-105C Navy trainers following transfer of this program from the Downey, Calif., plant. Resumed second production order for F-104, with first flight of Columbus-built F-104C in September. Completed production of F-86F.

Completed Navy modification program A-1 attack bombers. Expanded engineering work on new types, including a number of design proposals for advanced Navy aircraft.

• **Pasadena—Continued** manufacturing, modification, inspection and repair of F-86 day fighters and F-66D interceptors.

Foreign Operations

North American reports that during the year it delivered airplanes of two different types for sale by the Air Force, Navy and North Atlantic Treaty Organization countries. Eight of these programs involved jet fighters or interceptors.

Production of F-86 Sabre fighters and interceptor aircraft is now licensed in four foreign countries—Canada, Australia, Italy and Japan. Overhaul and repair of F-86 Sabres is authorized in a fifth country, Spain.

Missiles of Future Tested at North American

HIGH-THRUST rocket engines pour out enveloping smoke clouds during tests at Rocketdyne,

one of North America's three new divisions.



NORTH AMERICAN tests at Devens, Calif., where the Missile Development Division is testing the SM-64 submersible missile.



ARMAMENT ROCKETS developed by Rocketdyne are test fired in steel tunnel at the division's North Saan, Calif., laboratory.

F-105 Exceeds Mach 1 in First Flight

Republic Aviation's F-105A supersonic fighter bomber exceeded the speed of sound in its first flight late last month at Edwards AFB, Calif., and approximately 11 other flights have been made.

The event marked a strong bid by Republic to dominate the Air Force fighter bomber field.

The F-105 is powered by a Pratt & Whitney Avenger 37 turbojet which develops 10,000 lb. dry thrust. USAF said the new aircraft has about one-third wingload wing, a long reinforced fuselage, wing root air intake ducts permitting intake equipment to be installed in the nose cone and a nose gear drag tail set low on the aft section of the fuselage. A ventral fin on the bottom of the fuselage at section provides increased lateral stability.

The new fighter bomber can carry over long ranges at high Mach speeds without weapons in use in heavier loads of non-atomic bombs and rockets.

Russell M. Roth, Republic's chief experimental pilot piloted the plane on its first flight and reported "a very fine ride." The flight was made a month ahead of schedule and lasted 45 minutes.

Jackson Urges Navy To Speed Atomic Power

Washington—A crash-top program to convert the Navy to atomic propulsion and atomic armaments was urged by Sen. Henry Jackson (D-Wash.), Chairman of the Military Applications Subcommittee of the Joint Congressional Atomic Energy Committee.

In a letter to the Secretary of the House, the Secretary of the Navy, the Chief of Naval Operations and the Director of the Bureau of the Budget, Jackson specifically urged that funds be included in the Fiscal 1977 budget for the construction of an atomic-powered aircraft carrier.

"Aircraft carriers are particularly well suited for the early application of nuclear power, and extensive testimony... has convinced me that every new carrier for which authorization is sought should be atomic propelled," he said.

"The combination of nuclear propulsion and nuclear armaments—in an atomic-propelled submarine firing cruise missiles, or in atomic-driven aircraft carriers launching planes with atomic payloads—can give our Navy an offensive punch and defensive strength without parallel in history."

Jackson pointed to the recent rapid increase of Soviet naval power. "Twelve years ago, Soviet naval strength was at least insignificant when compared with that of the great naval powers. Today, the Soviet navy is the second largest in the world."

Guaranteed Wage May Be Industry Issue

Los Angeles—The aircraft industry may be next in line to face union demands for a guaranteed annual wage.

Leonard Woodcock, vice president of the United Auto Workers-CIO, said last week that as one of four negotiators the aircraft locally will seek not only a closed shop, but also job security of the type provided by the guaranteed annual wage.

"While we do not propose a mechanical application of the formula in the aircraft industry," Woodcock said, "we will nevertheless insist on our negotiations an security guarantee."

"Because of the sudden cessation of contracts by the Government and because of 'phoning out' aircraft work, we are probably more in need of guaranteed employment than any other industry with the UAW-CIO."

Woodcock said the union hopes to work out cooperatively with the aircraft companies a system of employment contracts "adapted to the special circumstances of the industry."

USAF-Army Missile Feud Flares

Washington—New tests of the Army's Nike anti-aircraft missile, in which it made only partially successful attempts to stop the Air Force's TM-61A Missiles from White Sands Proving Ground, N. M., have started another round of Pentagon controversy over the Nike's effectiveness.

Army Secretary Wilbur Bricker has made the fact statement that Nike "can track and not destroy any aircraft, no matter how high or fast the aircraft can fly."

Other Army spokesmen, in support of this thesis, have said there had been first firing against the Mustang which Nike was tested on both of two shots fired.

Air Force sources told Aviation Week there have been two engagements. In the first, a Mustang that had been used for various development purposes was fired upon by the Nike experiment.

It was known over the White Sands range at 15,000 ft. altitude, executed by one fighter plane.

Approaching the firing area, the two fighters passed off and for a short time befuddled the radar and interfered with control of the Mustang.

The TM-61 intercept and four Nike missiles were fired.

The first missed the target. The second missed, and it is believed it missed on the explosion of the first Nike, which was destroyed to keep it from coming down.

The third Nike had a power failure and the fourth missed the target and was destroyed.

Later, a second test was held with two Mustangs as targets. Four Nikes were fired at the first TM-61 and all missed. Two Nikes were fired at the second TM-61 and both hit the target.

It was pointed out that the Mustangs were not flying at maximum altitude

as speed and that no electronic counter-measures were used to jam the Nike control system.

An Air Force statement to announce that the Nike is considered as an anti-aircraft weapon but remains the stand-in taken for practical reasons.

"We are not opposed to Nike as such," one officer said, "and we wish it would work as well as it should. But the tests don't point it is a fully effective defense measure despite the current improvements."

New Dispersal Policy

Defense Department has issued new policies governing dispersal of industry to small concentrations of facilities within target areas.

The Defense Instruction No. 5218, it states:

• Where suitable reasons for its dissemination or development are practical, dispersal will be the key factor in selection of the additional source. This also applies to subcontractors' work.

• Dispersal will be one of the prime considerations in the location of new facility construction, particularly when feasibility of government expense or with U. S. aid to construction. This does not necessarily apply to new facilities which are under contracts to existing plants.

• All facilities in being will be considered as one or required to meet existing and new dispersal policies by eliminating existing production facilities. Even when it is made to be existing facilities before new plants are constructed.

• Dispersion of dispersal must be weighed against the urgency of early delivery of the end product needed.

The instruction was signed by Richard B. Eberhart, Jr., Deputy Secretary of Defense.



Rheem

GOVERNMENT PRODUCTS DIVISION

Just as the integrity of men like Washington is reflected in the fundamental strength of our nation, so is the integrity of government and industry reflected in the enduring strength of our democracy.

Integrity is inherent in Rheem. Performance, responsibility, quality... without compromise... are the foundations on which all Rheem operations are based.

They are the elements governing every process from research through engineering to finished product and are responsible for Rheem's service record of low per unit cost and on-time completion schedules. Rheem's Government Products Division facilities are presently in quality development and production on jet engines, missile and jet-engine components, airborne ordnance, electronics and entrance material.



YOU CAN RELY ON RHEEM

Rheem Manufacturing Company • GOVERNMENT PRODUCTS DIVISION
DOWNER, CALIF. • SAN PABLO, CALIF. • WASHINGTON, D.C. • PHILADELPHIA, PA. • BURLINGTON, N.J.

Research, development, production
of electronic computers for defense



Today our Armed Services are making valuable use of Burroughs Corporation applied research for analysis and study of original defense concepts; of our expert engineering for development and testing of prototypes; and of our manufacturing facilities for final production of defense appliances.

Burroughs' defense accomplishments embrace the fields of instrumentation, control systems, communications, magnetic and electronic computers and electronic computers. It is marked by achievements like the A-4 Gun Sight, the Skyweaver "bravo" ground guidance computers for high-altitude systems and other classified projects. Address inquiries to Burroughs Corporation, Detroit 32, Michigan.



Burroughs

BURROUGHS INFORMATION DIVISION FACILITIES INCLUDE:
Burroughs Corporation Division Design and Research, Burlington
Burroughs Electronic Instruments Division, Philadelphia, Pa.
Burroughs Division of New Jersey, Hightstown, New Jersey
Control Instrument Company, Brooklyn, New York
Burroughs Research Center, Pauli, Pa.

McDonnell Aircraft Expands Facilities

St. Louis-McDonnell Aircraft Corp. has reorganized and expanded its research and development activity and soon will open a new flight test base in an area remote from the congestions of St. Louis.

The company says these changes will be effective Dec. 1 to handle the greater R & D effort demanded by present and future contracts.

Four research departments and all laboratories in the Aircraft Engineering Division will report to the division's chief technical engineer, Vernon Christen.

Departments are aerodynamics, wind tunnel, thermodynamics and control dynamics. Laboratories are applied mathematics and all activities of the electrical laboratory except flight test instrumentation.

A new flight department will be formed and the activity expanded to cover flight testing for the airplane, helicopter and missile divisions. All pilots will be in the new department which will report directly to Kenneth Perkins, vice president engineering.

Reorganization of Aircraft Engineering Division laboratories under one head is expected to concentrate on equipment, personnel and tools. Service to various company departments will be made quicker and more efficient.

Expansion of the flight test depart-

ment is preliminary to selection of a site for the new test center in a specially selected area. McDonnell has found a community problem with its flight test work based at Lambert Field in St. Louis.

The new flight test department will be headed by Frank E. Christensen. It is expected that he will join the company Dec. 1.

Defense Department Liberalizes "Set Aside"

A new Department of Defense instruction (41609) aims to loosen small business participation in military procurement by knocking "set aside" provisions.

Under it all military procurement agencies are required to make "set aside" for small business, partial "set aside" also directed when a procurement can be split contractually, classed, or split in subcontracts. Projects need not be set aside for "set aside."

F-W Begins Production

The Focke-Wulf aircraft factory in Bremen has begun production of its first post-war aircraft, the 125-cup BL 162 (AW Sept 12, p. 45). The two-seater hopes to find an international, as well as a domestic, market for the light plane designed by Professor E. Pöschel.

Military Aviation Funds:

July-August

Defense Department had more than \$12.5 billion in hand for aircraft, engines, and parts procurement contracts on Aug. 31. During July and August, the first two months of Fiscal 1956, Air Force received commitments of \$1 billion more than the total of new contracts for aircraft, engines and parts. Army commitments exceeded new shipments by \$43 million.

Here are the details:

	COMMITMENTS \$100 Cdn. mil.	EXPENDITURES (\$100 Cdn. mil.)
	July-August August 31	July-August August 31
Aircraft, Engines, Parts		
Army	\$1,007	\$1,007
Navy	\$1,007	\$1,007
Air Force	\$1,007	\$1,007
BLUP	\$1,007	\$1,007
Total	\$1,007	\$1,007
Guided Missiles		
Army	\$1,007	\$1,007
Navy	\$1,007	\$1,007
Air Force	\$1,007	\$1,007
Total	\$1,007	\$1,007
Engines and Communications Equipment		
Army	\$1,007	\$1,007
Navy	\$1,007	\$1,007
Air Force	\$1,007	\$1,007
BLUP	\$1,007	\$1,007
Total	\$1,007	\$1,007

WE'VE
GOT 'EM

any amount
any kind
any time

plugs

CANNON
PLUGS

U.S.
RELAYS

GREMAR R.F.
CONNECTORS

WOODS
Aircraft Supply

309 West Elmwood Avenue
Burbank, California
Telephone: Wanda 7-0211
Burbank 3-8103

The right connection
for the right connectors



KC-135, shown during test with F40 chase plane, is leader of USAF's Stratotankers....



THESE ARE THE MEN (led by production pilot Clayton Scott at right) who tested it



BOEING 707 goes left to test high-speed drag boom.



FLIGHT-TEST SECTION led by A-111 Johnston directs 707.



WHILE MAGNETIC TAPE records response of the 707.



707 PRE-FLIGHT crewmember checks one of the pit engines.

New Boeing Equipment Will Speed Flight

By Irving Stone

Seattle—Testing of Boeing Airplane Co.'s 707 jet transport across the KC-135 jet tanker and advanced versions of the B-52 will be facilitated with new equipment scheduled for full operation at the company's large flight-test center by the middle of 1956.

One of the major innovations Boeing will introduce will be a high-speed set up for ground reduction and processing of airborne-recorded test data tape data similar to that at Convair-San Diego (AW Nov 16, p. 35). The installation will:

- Speed up transcription and reduction of flight test measurements.
- Reduce transcription manpower requirements through the elimination of manual methods.

This approach will make design changes easier and prevent later insertion of these improvements into production aircraft.

Representing an investment of about \$250,000, the new system will automatically translate into engineering form on about 12 to 24 hr the average 14 million data points from a single B-52 approximate test flight. Further engineering computations may be obtained directly from computer facilities in another 12 to 24 hr period.

In comparison, the present semi-automatic system used at Boeing's flight test section (AW Jan 4, 1954, p. 49) would take from 7 to 10 days to get the data processed.

432 Variables

The computer tape system will obtain a pulse-width modulation (PWM) test tape which will record 432 separate test variables two-and-a-half times per second.

A lesser number of test variables could be recorded at a higher rate.

In effect, this pulse-width modulation technique is as

adequate for bomber and large transport type aircraft use of the higher speed PWM encoded data applied to smaller and more fighter planes.

In the ground loading system, the lighter tape will be read continuously for translation of the data and further input to computer, so that essentially no manual operation will be required.

In addition to computer storage, which may run as high as \$300,000 a year, Boeing flight test data to the computer by magnetic tape will reduce computer work load by about 30%, thus making the device available for other jobs.

Already, Boeing is testing prototype airborne PWM equipment on its 707 aircraft. Corresponding ground handling equipment is now being tested for operation.

In 707 flights, Boeing instruments test engineers exactly on using the prototype equipment to check operation and reliability by procedures on an

Test Cycle

outline. This will insure that no real problem will exist when the KC-135 test program starts about the middle of 1956.

Heavy Load

Flight test load and perpetual phases for incoming aircraft are the heaviest in Boeing's history. Included in the flight test program:

- 707 prototype, being flown as a test vehicle for the KC-135 jet tanker-transport program and as a test plane for the production versions of the 707 jet Stratotanker.

Flight test planning is underway for completion tests of the jet Stratotanker, which to commence late in 1957 or early in 1958 with the first production planes.

- Test B-52s, assigned to various development programs in support of B-52 production. These programs are concerned with aerodynamics, powerplants, engine systems, armament, bombing and navigation, structural integrity and

systems. As many as eight B-52s have been in the air at one time when engaged in specific test programs.

- Two B-47s and one B-29, used for development and proving of armament systems for the B-52.

- Two XB-47s, serving as test beds for the Wright 340 turbo-prop. First flight of the XB-47D recently took place at Boeing Field (AW Sept. 3, p. 17).
- Two B-47s, for development of bombing and navigation systems for versions of the B-52 and other aircraft.
- Two YC-47s, turbo-prop test bed versions of the KC-135, are fitted with Pratt & Whitney T34. The first was delivered to Edwards AFB in August.

- Two F-96s, for testing electronic gear.
- Four B-36s, chase and observer planes in support of the B-52 and 707 programs. They have been used for aerial fighter attacks for B-52 armament tests, photographic coverage and ob-

servation of such things as bomb extension and retraction on the 707.

- B-45A, used for high speed, high altitude testing of targets for B-52 nuclear bombs.

- C-46, for loading parts, equipment and personnel between Boeing Field and Moses Lake Flight Center and other points.

All these aircraft, including those not specifically used as test vehicles, are serviced and maintained by Boeing crews.

Since Boeing's 36-engine flight test section started operations in 1954, actual hours in the air per test airplane have been topped up 300%. The airborne time is running about 80 hr per week on B-52s alone.

The cost of testing with B-52 assigned to the test program has been cut by 50% since 1953, when development testing (Phase I) of the plane began.

The flight test section now has more than 700 engineering employees. The

Cornelius

"PACKAGED" PNEUMATIC SYSTEM SAVES WEIGHT and SPACE

In fighters, bombers, aerial tankers,
transports, trainers and helicopters



COMPLETE PNEUMATIC PACKAGE

The Cornelius Compressor, Model 130, 21 CFM, 2000 PSI, is used in the McDonnell F2H-3 and F2H, North American F4J and F4J, Chance Vought F7U-3, and Grumman F11F-1. Also in use by the Lockheed F2V, Grumman XP-1, Martin TBM, Boeing KC-135, Boeing B-52, Convair Turboquest Airline and Canadian Mustang. Thousands of aircraft have under all service conditions are proof of outstanding performance.

The Cornelius Model 130 compressor is the heart of the complete Cornelius "packaged" pneumatic system which includes inlet air filter, starting relay, radio noise filter, moisture separator with automatic condensate dump and heating element, back pressure valve, check valve, relief valve and pressure switch.

Compact Design Saves Space—Entire air supply system occupies only slightly more space than compressor alone in conventional system.

Weight Savings of 6 pounds or more are possible by eliminating separate system components, moisture tubing, drains and line connections.

System Leakage is Reduced—In a continuous leakage integrative, components remove possible leakage sources such as flare connections and aging sealed fittings.

System Reliability is Assured—Because each integral component is designed specifically to give optimum performance in combination with the other components.

Time Saved by installation and servicing of one unit is another valuable benefit which only Cornelius "packaged" pneumatic system offer.

The Cornelius "packaged" pneumatic systems are available with other DC, AC or hydraulic master drives. Please write us in order that a Sales Engineer may discuss with you the application of this "packaged" system as well as the many other pneumatic components which we manufacture.

THE CORNELIUS COMPANY 350 - 29th Ave. N. E., Minneapolis 21, Minnesota

PIONEERS IN THE DEVELOPMENT OF AIRCRAFT PNEUMATIC SYSTEMS

feet is 100 more than was projected a year and a half ago.

More than 1,000 manufacturing representatives will take part in support of the flight test section.

These people maintain the test vehicles and install test equipment. All this work is done on a three-shift basis. Most work is conducted five days a week, the work frequently more in six and some days depending upon the urgency of the program.

The Engineering Flight Test section is headed by A. M. (Doc) Johnson, Johnson's administrative assistant is H. A. Rake.

The section operates through five units—experimental test pilots, flight test engineers, flight test technicians, production flight test and supporting services.

Experimental Test Pilots

This unit conducts flight to ground tests of the test aircraft and conducts their operational demonstrations.

Pilot recommendations in the past have resulted in the adoption of the F-52 standard landing gear, an improved lateral control system in modified finger type spool and improved longitudinal control in the control speed system.

Seven experimental test pilots are R. L. Louch, Jr.

Flight Test Operations

This activity establishes test plans, sets test specifications and procedures, determines and releases to the shop the configuration of the aircraft to be tested. For the test, plans the test and aerial tests as it with the pilots.

The operations unit also transmits and reduces flight test data and prepares and releases technical reports to research and development staffs and design groups (B-52 or F-77, as the case may be).

A special group has been selected from the operations unit to handle the F-77 test project, since it has both military and commercial aspects.

Other special groups include engine men concerned solely with work such as tanking and vibration system development, electronic systems-developing equipment, etc.

Head of Flight Test Operations is G. M. Stewart.

Flight Test Instrumentation

This unit is concerned with design, development, procurement, distribution and operation of instrumentation used in the various test programs.

Involved in its work is approximately 57 sections in equipment, ranging from a simple transducer to the extensive and complicated magnetic tape recording

MALLORY-SHARON reports on

TITANIUM



The prototype Convair F-102A (which carries the design designation of Republic Model 102) will be tested in 1955 by Convair.

This jet's engine

wears a wrinkled jacket

HERE'S Convair's F-102A, new entry in the supersonic field. Original models used a titanium shroud—or jacket—for the jet engine to save 40% in weight over a comparable steel part. In the latest models, Convair has introduced a new wrinkle to save even more weight.

Notice the daunted appearance of the engine jacket? By damping or "dampening" the entire surface, thinner gauge titanium can provide the same structural strength as a thicker smooth piece.

New forming techniques like this have been made possible in recent months because of major improvements in titanium's mechanical properties, and much stricter quality levels. At the forefront of such developments you'll find Mallory-Sharon, leading producer of titanium and titanium alloys.

Use our experience for your applications of this strong, lightweight, corrosion-resistant metal. Write Mallory-Sharon Titanium Corporation, Niles, Ohio.

MALLORY  SHARON

NEW Bendix MARKER RECEIVER

(1/4 ATR)



Compact...Rugged...Weights only 8½ pounds!

Now from Bendix®, makers of the world's standard in Marker-Beacons, comes a big advancement—the MKA-7A. Completely new from chassis to case, the Bendix MKA-7A Marker-Receiver is designed for dependable, trouble-free reception of signals from aeromaps for enroute, station locator Z markers and ILS approach courses.

Smaller in size, lighter in weight, it is scheduled for use in Pan American Airways new fleet of DC-7Cs.

Operating on a fixed frequency of 75 megacycles, the MKA-7A features a required circuitry that performs a two-fold function:

- (1) Greatly reduces the chance of television or FM interference.
- (2) Stabilizes gain under wide ranges of environmental conditions and line voltage fluctuations.

For further information, contact your Bendix Aviation Radio representative or write the factory direct. Address below.

*No. 6-5-50-08

**BENDIX RADIO
DIVISION
BALTIMORE 4,
MARYLAND**



SPECIFICATIONS

- Antenna impedance less than 12 to 1
- AVC characteristic Audio output in within a 4 db range at a signal level from 400 to 200,000 micro volts
- Sensitivity Attenuation 100 db (readily more than 40 db less than 120 db)
- Receiver stability 4 to 10 to under all service conditions
- Balance of response curves Intermediate band rejection channel selectivity (rejects) will not produce less than 40 db of total output up to 3.4 mcs
- Audio output impedance 500 ohm, constant
- Power requirements AC Power: 115 volts ac, 500 VA; 115 volts ac, 27.5 watts dc for CRO CRT video output or 100 VA
- DC Power Supply 115 V, 100 VA, 100 VA
- Altitude performance Operates at 10,000 feet altitude
- Ambient temperature rating -40°C to +50°C (-40°F to +120°F)

Specifications subject to change without notice

Wheat Ridge Sales
12000 Resolving Road
North Hollywood, California
Export Sales and Service
Bendix Aviation Radio
2001 West 1st St., N.Y.C.
N.Y. 10014
Canadian Distributors
Aviation Radio
100 Lawrence Road
Markham, Ontario

entire Boeing now in preparing to install.
Head of Instrumentation is F. E. Woods.

Production Flight Test

This activity determines the procedures to be used for functional flight test of the production planes and conducts these tests.

Its responsibility is to deliver a fully operational article to the customer but it also to do this with a minimum number of flights, because of the high cost involved.

One big job of the unit is to keep track of repeated malfunctions and so for these back to Manufacturing and Engineering for proper attention.

Head of Production Flight Test is C. L. Scott, who was the personal pilot for company founder W. E. Boeing.

Supporting Services

This unit coordinates, plans and procures flight test facilities. Thus, it also has to make arrangements for remote base operations, for example in connection with special 8-12 or 707 tests. It also includes design and operation of all ground test cells to collect at Boeing.

Supporting Services, now has in operation a multi-channel receiving and transmitting station which handles all Boeing test traffic in the western Washington area.

This unit coordinates all flight crew members in the use of flight equipment and supplies. Lack of instrument in pilots stationed at Boeing Field. It maintains all the various flight crew equipment.

Head of the Supporting Services is Henry R. V. Beane.

French Govt. Will Buy 20 Breguet Dux Ponto

The French Air Force announced plans to purchase 20 Breguet Dux Ponto double-deck transports plus their overwing pods. Delivery of the transports is currently scheduled to be completed by 1975.

The move apparently was an effort by the French government to bolster the shaky financial position of the transport manufacturer, Aerospatiale. Louis Breguet, said, at the same time to keep some of its own losses. The government, said, is heavily in debt to government financial agencies several years ago through heavy investments in the development of the Dux Ponto which failed to find buyers. Breguet also has been awarded a contract by the development of the Twin light engine for the North Atlantic Treaty Organization.



happy when the heat's on!

Hydro-Aire's latest Hot Air Valves are designed for operation at 500°F, pressures up to 250 psi, ambient temperature over 500°F.

How can we meet these requirements? Well, our design experience is only the start. It includes Piston Plug Valves, Butterfly Valves, Sliding Gate Valves, Pressure Regulators. And you can have them adorned with actuator, motor actuator or pneumatically actuated.

The valve (fastened in our 20-079 Pressure Regulator, as supplied for the latest most powerful jet engines now in production. Write to Hydro-Aire for complete design data.



hot air valves

by

HYDRO-AIRE

who also make
hydro • TURBO MACHINERY
FUEL VALVES • HYDRA PUMPS

BUREAU OF AERONAUTICS
BUREAU OF AERONAUTICS

BURBANK, CALIFORNIA • Aviation Subsidiary of CRANE CO.

THE MOST POWERFUL JET ENGINE IN THE WORLD

GYRON

DESIGNED SPECIFICALLY FOR SUPERSONIC FLIGHT

INITIAL TYPE TEST — 15,000 lb. STATIC THRUST

WITHOUT RE-HEAT



DE HAVILLAND ENGINES

THE DE HAVILLAND ENGINE COMPANY LIMITED, LEYTON, LONDON, ENGLAND

Boeing, Douglas Swap Techniques In Designing Competitive Jetliners

By George L. Christon

In designing their respective and competitive jet airliners, Douglas and Boeing have swapped techniques. Boeing's 707 jet prototype has the shape of Douglas's 4, and Douglas plans for the DC-8 have a Boeing look about them. These design concepts are especially noticeable in the engine layout, flight-control boost and cabin cooling systems as proposals made by the two competing companies to Pan American World Airways and United Air Lines.

They include:

- **Cockpit.** Boeing's 707 has a typical DC-6 type cockpit. It is built to about the same dimensions—4 in. long—and has the flight engineer's position behind the pilot. The control panel is to the right.

The cockpit of the Douglas DC-8 is about as square as the Stratocruiser's and has about the same amount of visibility.

- **Control boost.** Boeing, which used hydraulic boost on the Stratocruiser's rudder control system, has gone to complete aerodynamic boost on the 707's flight controls—elevators, ailerons and spoilers. Spoilers, which can operate differentially as ailerons or symmetrically as air brakes, are hydraulically operated.

Douglas, whose entire series of DC-6s and -7s use aerodynamic boost on all three control axes, has gone only to hydraulic boost on the DC-8's ailerons and rudder control systems. Elevators are still aerodynamically boosted.

- **Cabin cooling.** Boeing uses a Finna cabin cooling system on the Stratocruiser but has switched to an air cycle cooling system on the 707.

Douglas uses an air cycle system on its DC-6s and -7s but will go to a Finna system on the DC-8. (Since DC-7s, such as *American Airlines'*, have a Finna refrigeration system, but it is possible to seal the cabin on the ground. It can be used, however, to supplement the air cycle equipment while airborne.)

DC-8 Questions

Some design details are confined to part or "if" in front of DC-8 delivery dates.

They are the plane incorporates a number of unconventional design features. If these fail to prove out as expected, it might mean an extensive redesign effort. Coupled with the change in the customer prototype being provided by the manufacturer,

the flight tests on pressure delivery rates, these details are. Among the unconventional features:

The DC-8 does not have the usual high-speed stream or spool.

- **Slant landing gear.** is built for a transport plane in that it rotates 99 deg. to retract into the fuselage.

Engine Availability

Also all concern to some extent is the question of availability of transport engines to power the various versions of the Douglas DC-8—an apparently better plane than the 707. One airline official says: "With the presently proposed Pratt & Whitney JT3D, the conventional DC-8 could

have stages from Greater to Shannon can stop."

P&W's JT5 would give very improved performance, but the earliest date a commercial version of the engine will be available to them probably will be around 1968-69, they say.

The situation is agonizing, they claim, because engine manufacturers can not obtain any performance data on the JT5 due to security restrictions. Even on the much publicized, much-used JT7 only while personnel with a secret clearance may have access to complete engine specifications and performance data.

Water Injection

JT5s on both the DC-8 and the 707 will require water injection under all thrust conditions except those made with ambient temperatures under about 42,500°. Some 400 gal of water (no methanol added) will be used in the initial two minutes of the plane's take off. On the 707, water injection pumps will draw a 40-lb from the plane's electrical system.

The water system will present no burning problem. It will be enough to freeze the air will be dense enough to eliminate the



BOEING borrowed from Douglas in designing the 707 above, slide 1



... DOUGLAS, in turn, used some of Boeing features in designing the DC-8.



What's your need in SUB-CONTRACT PRODUCTION

Whatever your need...
PASTUSHIN will work with you!

Call on Pastushin if you need a fast, dependable source for precision-built aircraft structural and mechanical components, external stores and ordnance components and installations.

Here you'll find the services of an airplane-experienced engineering staff...complete and integrated plant facilities backed by skilled production specialists...excellent equipment, modern and enterprising management.

Let Pastushin assume full responsibility
for your manufacturing problems.



PASTUSHIN
AVIATION CORP.

LOS ANGELES, CALIFORNIA

Ready to talk about your plans?
Call in a Pastushin specialist.
Just write, wire or phone.

PASTUSHIN AVIATION CORP.
1611 West Century Blvd.
Los Angeles 45, Calif.

Gentlemen: I'm interested in learning more
about your facilities.

Name

Position

Company

Address

City State

need of water for bleedoff. If water is needed, the entire quota of 400 gal. is used during bleedoff and refuel stands, as water is kept in reserve in the tanks when the aircraft changes so altitudes at which sub-zero temperatures exist.

Not will water be required for a go-around because of the coolant or lubricant characteristics of the two-speed turbojet, no ice masses are.

Reverse Thrust

Being a strengthening several reverse thrust proposals but believe one of its own design is a definite one (AVW Apr 15, 1964, p. 25).

The Boeing device consists of two air deflector which fit back to the contour of the nacelle airbody in flight. Upon landing, deflector slide out from nacelle sides and all air that can be blown at both deflector meet over the jet's exhaust forcing most of the blast forward along the deflector at approximately a 95-deg. angle to engine thrust line.

Douglas also has its own design in the works. The Douglas proposal consists of two lowered sliding panels which are normally retracted into the nacelle airbody sides. When extended aft in provide reverse thrust, the two sections come together in the center of the jet exhaust blast, deflecting most of it forward through the lower fan.

Observers estimate that reverse action of either proposal would be about equivalent to that provided piston engine planes with engine idling and propellers in low blade angle forward pitch.

Structure Comparisons

The 707's structure is of subpath design. In even, load-bearing structure in the airframe there are at least three load paths. Any one of the three can load without making a stress transfer failure.

In the DC-8, one of redundant structure in the fuselage has allowed Douglas to build a "one stop" into the body of 10-in. materials. The result is that a fuselage skin can handle from excessive differential pressure on up open to a maximum length of only 24 in. This will prevent other possible turbulent decompression.

The DC-8's wing structure represents a radical departure from conventional design. Wing skin is collapsed into not a wing tip, with large sheets of wing skin to keep number of panels to a minimum.

The 707's wing skin is applied in the more conventional manner—constant thickness panels are used with part becoming progressively thicker towards the wing tip.

Douglas uses sparless, wing strap-



707-DC-8 REVERSE THRUST proposals. 707's deflector panels fold in to offset path, forcing blast forward. Douglas does this by sliding lowered panel into path.

on with shapes developed by NACA for efficient load-bearing characteristics—a "Y" shape for compression loads on the upper surface and a modified "I" shape for tension loads on the bottom skin. Result is that the wing's skin/strut/compression carries 75-80% of wing loads, the three spars only 20-30%.

Straps are spread along wing skin every 10-in. center. Front and rear spars

are together four feet to tip (not at root). Center spar runs from root to outboard engine pylon.

Hydraulic System

Both aircraft will use regenerative, variable-displacement hydraulic pumps (one per engine) to supply main system hydraulic pressure at 3,000 psi. Both jets will have electrically driven auxiliary pumps to supply pressure in



IN MODEL DOUGLAS design, leading gear wheel rolls 90 deg. to retract into Douglas

Amcor's most complete line of arc welding equipment and electrodes.



They're welding titanium down to .016" at Ryan Aeronautical Company

P&H Welders, with their instantaneous remote control and wide welding range, make this tough job easier

When you have a tough material to weld such as titanium, titanium or special alloys, P&H high frequency welders, AC or DC, really come into their own.

You see, P&H welders have what we call "Distance Control". It's an exclusive feature that provides instant titanium heat control right at the work. There are no moving parts or rods or wheels to bump or jam any. In addition, P&H welders have an extremely wide range. On one of our models for example, you can go all the way from 475 amps down to 2-amp.

But we were talking about titanium — a tough material to weld in today's aerospace. Here's what they say at Ryan where they use P&H high frequency welders. "There is lots of a problem welding titanium. In many cases have been led to believe. With titanium, we also go to very deep at Ryan on welded

as for available. We have been down to .016" on this most material." May we add again that it's P&H power heat control and wide range that makes such a performance possible.

If you have tough welding jobs to do . . . If you wish to boost production and cut cost, standardize on P&H welders. Ask your P&H representative or distributor for all the facts. Or write for latest brochure.

**P&H WELDING DIVISION
HARNISCHFEGER
CORPORATION**

3400 W. BROADWAY AVE. • MINNEAPOLIS 40, MINNESOTA

case of main system failure.

Systems which will be hydraulically operated on the 737 are landing gear actuators and extensions (in case of hydraulic system failure, all gear can be mechanically unlocked, will free fall and lock in down position), wing flaps, low speed brakes, speed brakes, wheel brakes, nose wheel steering and road-wheel steering.

Hydraulically operated extension on the DC-3 and the landing gear (with emergency mechanical extension), wing flaps, speed brakes, wheel brakes, nose wheel steering, idler and rudder boost. The DC-4 has no windshield wipers, ones incorporated in pitot static system.

Stalled 500, low-temperature development of standard Stallid, will be used in the hydraulic system of both gear. The final gear point is -100F. Maxium Chevrolet Co. and Douglas incorporated in development.

Electrical Systems

Both planes incorporate highly developed, completely automatic, modularized, alternating current electrical systems.

For the first time in commercial aviation, batteries are eliminated.

The 737 system at 28 v., 3 phase, 400 cycles. The small amount of d.c. current needed for some instruments and the radio is obtained from transformer-rectifiers.

Systems of both planes automatically isolate any defect in the a.c. circuit and turn on lights to inform the trouble for the pilot or flight engineer.

Pressurization & Cabin Cooling

On the 737, all air bled from the engines, whether for pressurization or deicing, is bled from the 17th and 18th stage (at about 427F) and is immediately filtered. Pressurization and cooling are performed through them as early as the first bleed hole. It is then the 17th stage.

On the DC-8, air is bled from the engine's second stage (at about 710F) but cooled to 420F by an aftercooler/primary separator to drive four air conditioning packs. Each pack has two heat exchangers. A pair of compressors is located on each side of the main wing rail.

Cooling is supplied by two additional air exchangers. From wing air, compressors. Normal cabin operating differential pressure is 5.07 psi.

De-Icing

Bleed air engine bleed air to de-ice wing leading edge of the outboard engine area. Staleness are electrically deiced. No anti-ice protection is provided for the wing from nose to out-



737's sharply swept-forward engine pylon is easily accessible from the ground.

board panels, the four engine struts or the vertical gear.

Douglas cyclot engine bleed air to all wing, engine strut and engine leading edge.

The double-walled titanium section of the DC-8's compressor, breather, fan, and gas turbine systems for the engine's section.

Pressurization for low outgassing on the 737 has not yet been worked out in detail.

The Boeing's silica windows will measure 5x7 in. Long and vertically, will be made of laminated glass and will be heated 20 in. an hour.

Two normally close spring system that compresses air on the side (three shock absorbers) will have a good view.

The Douglas jet will have elliptical windows like with the long but not too thick like those of the Vickers Viking.

Erasing the Noise

Boeing is investigating a novel way of cutting out noise in the 737 transport. A microphone and amplifier would pick up the frequency of noise entering the cabin. Loudspeakers located in the bottom of the baggage rack at each end of seats would produce the opposite phase.

If the system works, the two sounds will cancel each other out.

aircraft will be either stretched Douglas 55 or C-119, a plane produced by General Aviation. Spacing will be every 40 in.

The 737 cabin incorporates a new modular system for passenger service. Four 15-in. square modules contain all essential services—one each for light and full, paper (no toilet), food, and engine. One complement of four modules takes up the 40 in. between seats. Moreover, the modules are built modular, like the seats and if seat spacing is changed, the module spacing may be altered in a corresponding manner.

Loading Gear

The 737 uses a four-wheel main gear with wheels as a tandem bogey arrangement.

The minimum turning radius is restricted to main gear describing a 21-ft-diameter circle.

The DC-8's main gear lines up the four main gear with a rail on each side of the main gear. This allows them to pivot on either gear. Industry sources say that Douglas hopes to put each pair of tires on one wheel, thus cutting total number of wheels which from four to two. Gear has to rotate 90 deg. during maneuvers to slow in landing.

On both aircraft, main landing gear is attached to special box structures in the wing instead of to the main wing



All welding equipment is manufactured and sold in Canada by HARNISCHFEGER MANUFACTURING COMPANY LTD., 440 King Street West • Toronto, Ontario, Canada

Engineers with an eye to the future....

In the fields of tracking systems and optical missile guidance systems, the H. A. Wagner Company has a record of outstanding contributions. Under the direction of Dr. Herbert A. Wagner, developer of the first tactical and guided missile weapon systems, this company is now engaged in a long-term missile guidance system development program.

Now is an exceptional opportunity for physical and engineering engineers in the fields of system design, electronics, mechanics optics, missile flight testing, telemetry and precision engineering to join a group of outstanding engineers and scientists engaged in a vital and challenging endeavor. Unlimited possibilities exist for a small number of well qualified people. You are invited to submit a full resume.

Developers of Missile Guidance and Tracking Systems... (Simulators and Trainers)

H.A. WAGNER COMPANY

14100 KENWOOD STREET, LANHANS 146, ANTIPOLO COUNTY, CALIFORNIA

space. This will allow a main gun to be washed out without necessarily replacing the plane's integral wing fuel tanks or damaging the wing itself by need appear in a weekly the case with today's aircraft.

Other Details

Douglas hopes to get a 4 mph boost in its DC-3 by changing the exhaust from its air turbine drive and take you a special air-firing nozzle mounted on the entire bottom of the fuselage.

The plane has a 300% skin factor built into the fuselage at the main wheel well area. If the 11-ft-long keel which normally carries loads through the main fuselage skins are taken over by two heavy 10-ft-long fuselage built into the fuselage just below the keel line.

The 707 has electronically-driven fuel pumps to dump fuel from wing center section tanks (located in the fuselage) which help bring the plane down to landing weight in case an emergency landing has to be made shortly after takeoff.

Aircraft Probed

Airline engineers quote their company test plans as having high point for the 707's future characteristics. Approach and landing speeds are at least identical to the DC-7 and control response is more than adequate, especially on the roll axis, this so engine acceleration is equal to or better than current piston power plants.

Engine controlling depends on ground, is possibly simplified since a single throttle per engine takes the place of throttle, propeller control and engine control of the piston horsepower.

Cornell Building Gun-Rocket Range

Cornell Aerospace Laboratory Inc. plans to build an underground firing range for research and development on aircraft small arms and rockets, under a contract with U. S. Army Ordnance.

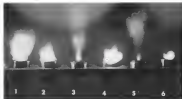
The range will be used to study internal, external and terminal ballistics of guns and small rockets. It also may be used to investigate aerodynamic and stability characteristics of projectiles before at supersonic speeds.

The new facility will include an 84-ft long underground tunnel for test wide and as fast back. At the end of the range will be a two-level range house. The lower floor will contain an enclosed test cell and extensive remote controls, instrumentation and equipment for test preparation. The upper level will house the main preparation area, work space for a range for low velocity firing, instrumentation storage of equipment and instrumentation and a photographic dark room.

The new range, which is expected to be ready in an month, will cost about \$12,000. It will be located adjacent to Cornell's present buildings in Ballis, and will take the place of a previously used outdoor range.

New Weber Division

Weber Aircraft Corp., Burbank, Calif., has established a new Passenger Seat Division, to specialize in the design, engineering and manufacturing of carbon, functional, standard and high-density aircraft passenger seats.



New Igniter Projects Longer Spark

Comparison test of new and, or combined pop, jet engine systems (AFW Oct. 14, p. 4) and standard, multi-type units show new plug populating spark better into jet's combustion than standard igniter. In the photo shown, jet plug ignites in position 4, 5, 6. Plug ignites in position 2, 4, 6. Plug ignites in position 4 and jet with jet's 4-plug igniter system. Scientific Div. of Weber Aircraft Corp., which made the igniter, is conducting the tests for Wright Air Development Center.

Military Standard TEFLON SPIRAL BACK-UP RINGS



- 302H130 and 302H130 rings produced under MIL-Q-985 quality controls.
- Assured for dimensional stability with all properties certified to AMS-2052. Complete range of sizes for use with AMS21 and AMS210 "O" rings. Produced in tolerance conditions on supporting standards to preserve shape. Send for data.

RESISTOFLEX Corporation

Bellevue 1, New Jersey

"FLEX" is a patent trademark for the above Resistoflex name.



"Get Your Air the Positive Way"

ORZO BY THE AIRCRAFT INDUSTRY FOR:

- Jet Engine Shortens
- Cabin Pressurization
- Simulated Altitude Conditions
- Ground Air Conditioners

SUTORBILT CORPORATION

2020 Red Shores Avenue

Los Angeles 58, Calif.

Auto Phone: LA 9100 7-1228

Auto Office: W 9100

Why major aircraft manufacturers depend on

WESTERN GEAR

Because they know they can count on Western Gear designed and engineered components for lasting performance in their aircraft. And they know they can rely on 80 years of service to the aircraft industry for correct design and superlative construction, a better power takeoff, turbine drive, complete systems or vital critical components of virtually any description. Send us details on your mechanical power transmission problem. Our engineers will be glad to make recommendations, help you come up with the right answer.

WESTERN GEAR provides power for **LOCKHEED MERCURY!**

WESTERN GEAR helps fly **SAAB**

WESTERN GEAR helps fly **SAAB**

Address General Offices, Western Gear, P. O. Box 181, Elvert, California.

WESTERN GEAR Corp. **W-G**

END USERS AND MANUFACTURERS



ORYX gas generator. Vertical duct at left supplies power to helicopter blades.

Napier Oryx

• Length	55.5 in.
• Diameter	19.21 in.
• Weight—engine only	60.5 lb.
• RPM, max	22,900
• Gas mass flow at takeoff	244 lb./sec.

two parts, hot turbine exhaust is sent past cooler compressed air. The high valve in the output duct drops the flow coefficient during start and the butterfly valve gives a variable area waste outlet.

The compressor's natural surge margin is further increased at low speed by a speed sensitive servo control operating the variable angle inlet guide vanes.

Upstream bearings in the combustion chamber keep the event length drive and will handle very high axial loads.

The two-stage reaction turbine is designed to operate against high back pressure in the output duct due in part to the flow from the oppositely directed swivel compressor.

Cooling Envelope

The inlet air is double-cooled to the swivel compressor in terms of a cooling envelope around the inlet air heat exchanger. This cooling effect runs twice along the length of the vertical ducting up to the inlet head. High inlet air head cooling also comes from the sub-stage bleed air.

Before choosing the present design, Napier considered a ducted fan core engine. The engineers found that the aerodynamic losses of the necessary duct length added to the increased diameter of such an engine offset its advantages.

Napier development of the Oryx will be directed towards getting up to 900 shp from the same basic engine for the Boeing P-101 helicopter, a future development of the P-7.

Titanium Extrusion

Research on aircraft titanium tube stress by Battelle Memorial Institute indicates that use of alloy rather than flat steel in the extrusion of metal is titanium has results in improved metal flow and surface finish.

Optimum die angle was found to be about 130°. Titanium mechanical properties were obtained at stresses comparable to the alpha phase region of the unalloyed titanium and in the alpha beta region for Ti-6Al-4V. Lubricants containing graphite, molybdenum disulfide and silica produced acceptable re-

Napier Schedules Oryx Type Test

Napier's Oryx gas generator, designed primarily as a helicopter powerplant, completed 1,500 hours of test running. Its type test is expected to be the end of the year.

High efficiency, good controllability and small diameter are the three principal design features of the Oryx. The makers, D. Napier & Son Ltd., say the first two features stem from "typical" Napier compressor characteristics.

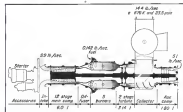
- Best efficiency point well removed from surge.
- Stability is throttle-hunt.

The small diameter is the result of carefully choosing the compressor geometry. The present compressor with its 6-in. diameter states is the smallest ever type in Britain.

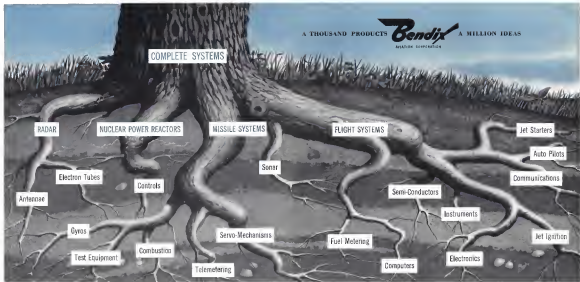
Thermodynamically, the flow from the inlet compressor goes directly into the vertical output duct. At the same time, the flow from the forward compressor reaches this duct by way of the turbine, where some of the energy is subtracted to drive the system.

The maximum flow of gas generated—144 lb./sec—is composed of about 100 lb./sec. of gas generated by the inlet compressor and 44 lb./sec. of gas generated by the turbine.

The maximum flow of gas generated by the inlet compressor is 144 lb./sec. is composed of about 100 lb./sec. of gas generated by the inlet compressor and 44 lb./sec. of gas generated by the turbine.



SCHEMATIC of Napier's Oryx generator shows gas flow and engine layout.



Bendix reliable components + Bendix systems engineering + Bendix proven production ability assure **DEPENDABLE SYSTEMS**

The more deeply rooted you are in all the things of which systems are composed, the better able you are to produce completely dependable systems.

Having produced millions of components, sub-systems and complete systems for many years, Bendix Aviation is the logical direction to look for systems to solve many current problems as well as others anticipated. Bendix assets for systems work include:

MAN POWER—An engineering and research staff of over 5000 with a broader range of technical abilities than any in the country.

ENGINEERING AND RESEARCH—Over \$89 million

was expended on these functions in fiscal 1966.

PRODUCTION FACILITIES—Twenty-four widely dispersed manufacturing divisions located coast to coast employing nearly 58,000 people.

SYSTEMS PLANNING GROUP—Coordinates major systems work, giving you a single, centrally located contact—the Bendix Systems Planning Group, Bendix Aviation Corporation, Fisher Building, Detroit 2, Michigan.





FUEL LOAD LIMIT CONTROL for the Viscounts

... Another **SIMMONDS Pacitron** "First"

Something new has been added to gasoline engine operation. PACITRON now makes provision for the use of fuel limit control, the automatic control of fuel tubes allowed in second-stage fuel pump systems. Simmonds advanced electronic fuel pump systems are now flying as standard equipment on the new Viscount Viscounts for U.S. and Canadian Air Lines. PACITRON electronic fuel pump systems were specified to furnish these new turbo-prop engines with the most versatile method of measuring and managing fuel.

In addition to fuel limit control, PACITRON can include these additional fuel management functions: control of priority control by fuel transfer or extended usage, fuel quantity signals, installation and interlocking for remote readings. Simmonds gauges were also specified for measuring the water-methanol systems on the Viscount Viscount. In addition to fuel and water-methanol, Simmonds equipment has been successfully used for engine oil, intake and other hydro-carbon liquids.

Simmonds contracts as "first in electronic fuel gauging."



The John Hughes—White Pacific fuel gauging system provides fuel in no greater as well as fuel measurement.



**SIMMONDS
AEROACCESSORIES, INC.**

General Offices: Ferrytown, New York

Branch Offices: Detroit, Michigan • Dayton, Ohio
St. Louis, Missouri • Dallas, Texas • Wichita, Kansas
Glendale, California • Seattle, Washington
Sole Canadian Licensee: Donnan's Aeroaccessories
of Canada Limited • Montreal



AUTOMATIC TUBE TESTING machines, such as this one at Hughes' inside plant in Tucson, are used extensively throughout the industry. Arinc tests them for any extra stress problems for the military and the aviation and aircraft industry.

Arinc Warns That Special Tests Of Vacuum Tubes Can Backfire

By Philip J. Kloss

Washington—Special tube testing and processing procedures now being set up in more and more military and aviation equipment manufacturers to improve reliability may actually be counterproductive and, in some cases, even dangerous, they are creating a potential production bottleneck that could plague both industry and military in the event of a shooting war.

This warning, in the form of a special report prepared at Defense Department request, comes from the Military Electronics Reliability Project at Aerocontract Radio Inc. This Arinc group contracts with the nation's top experts on the subject of tube reliability.

Arinc's warning stems from a recently completed survey of practices and the results of special tube processing procedures employed by an industrial manufacturing.

Arinc's warning stems from a recently completed survey of practices and the results of special tube processing procedures employed by an industrial manufacturing.

The Mouth "Witchcraft"

Arinc is not easy to recommend the discarding of certain practices, such as the widely used tube aging (burn-in), despite what it believes is strong evidence that this procedure is no longer justified. Many of the special processing

and test procedures now in use "were adopted under 'panic conditions' to meet production commitments, without time to evaluate the validity of the test criteria, Arinc feels.

This explains the lack of consistency of test procedures employed by different companies, and even within a single company. For example, a manufacturer with military programs for both Air Force and Navy uses, despite different screening tube inspection procedures for each program, Arinc finds, and says that there is the mouth "witchcraft" and too little science in present tube processing programs.

Arinc's Recommendations

Arinc has no quarrel with the use of acceptance sampling procedures during screening inspection to provide the basis for accepting or rejecting an entire batch of tubes.

What it does object to is 100% testing of tubes in a screening procedure to criteria which are not included in the base MIL-E-18 processing spec, especially when there is no attempt to evaluate the merit of such special criteria.

The organization therefore has recommended to the Defense Department that it support a cooperative study which would prepare to evaluate some of the special test procedures now employed in the military and aviation equip-

ment industry. Following such an evaluation, Arinc proposes:

- Incorporation of test procedures and criteria which assure tube reliability and make it possible to perfect reliability, as the MIL-E-18 tube spec. These procedures then would be included by tube suppliers.
- Review of test procedures and criteria which show no merit and prohibition of the introduction of new process procedures, unless special benefits are proved.
- When present MIL-spec performance criteria for tubes do not meet industry's requirements, tube development programs should be established to meet industry's needs.
- A system should be set up to provide for timely modification of MIL tube spec performance criteria as one or more tube makers show their capability to produce higher quality tubes.
- Equipment makers should submit monthly reports on the results of their lot sampling evaluation of the quality of screening tubes.

Arinc also recommends that the Defense Department set up prescribed tests for aviation equipment. These would be conducted on development and preproduction models as well as on production units to be sure that:

- Tubes are being used within their prescribed (MIL-E) ratings.
- System performance does not depend upon tube properties not specified in MIL-E-18.
- When MIL-spec tube performance criteria are not met, adequate corrective information is made available on specific tube requirements needed by industry.

Grounds for Suspicion

The results of Arinc's survey of its members' manufacturers provide good grounds for suspicion that many of the obsolete 100% inspection procedures now in use do not pay off in increased tube or equipment reliability. For example:

- Extensive data from one manufacturer showed that a batch of tubes rejected during screening inspection, but then rejected (reworked) in service in the aircraft, showed no more failure during production-line testing than other batches of tubes which had passed screening inspection.
- The aircraft manufacturer which rejects the greatest number of tubes during screening inspection has the highest overall production failure rate of the group. Despite the high initial tube rejection rate, this manufacturer suffers more additional tube failures during subsequent production line testing than

ANOTHER FIRST BY



Dynamic Integrating Gyro Servo Table



Greenleaf Manufacturing Company, as a producer of Integrating Gyros, realized the need for a Dynamic Integrating Gyro Servo Test Table. This Test Table was designed and developed to facilitate the evaluation of Integrating Gyros, and Greenleaf now makes this valuable test unit available to industry.

The Gyro Servo Test Table can measure the following characteristics:

1. The drift rate of the gyro unit
2. The current product angular velocity sensitivity ratio.
3. The characteristic time.
4. The angular velocity level voltage rate output sensitivity.
5. Minimum rate detectable
6. High limit angular velocity deviation of performance.
7. Low limit angular velocity deviation.
8. Signal generator linearity.
9. Torque generator linearity.

Since a time interval meter is incorporated in the system, the following data can also be obtained:

10. Spin motor excitation frequency.
11. Spin motor excitation voltage.
12. Spin motor excitation current.
13. Signal generator excitation current.
14. Signal generator null output voltage.
15. Gyro coupling gap temperature.
16. Accurate determination of the input axis.

THE **Greenleaf** MANUFACTURING COMPANY

ENGINEERING • DEVELOPMENT • PRODUCTION

7814 Maplewood Industrial Court • St. Louis 17, Missouri

Products of the IBC-2 and IBC-4 Gyros, Rate and Free Gyro, Differential Pressure Mech Motors, Air Speed Indicators, Computers, Switches and many other precision-built components.

None of the other five missile makers • 45% of all tubes rejected by the six missile makers during production line testing later were found to be within prescribed MIL-E-18 limits. This indicates that the true cause of rejection was basic equipment (current) design incompatibility—due to tube requirements which are not fully reflected in the MIL-E 18 specs.

Possibility of Special Selection

When Avco equipment is made manufacturers set up test requirements which are different in many respects than those contained in the MIL spec, then are meeting to special selection.

While this may be acceptable as an interim measure, it is slow to conduct it across various production lots for the tube industry and the missile service. Avco points out: For example:

- Degraded usable performance, or complete failure, will result when the military uses standard MIL tubes for field maintenance to replace rejected tubes with selected characteristics, as issuing that the equipment does indeed require specially selected tubes. (Tubes rejected by Avco manufacturers which otherwise meet MIL-spec performance limits, may later fail when used in military field replacement stocks.)

The only alternative, which poses a serious logistics problem, is for the military to stock separate groups of specially selected tubes for each type of missile and missile equipment.

- Serious production bottlenecks in the event of a shooting war is created by the large number of good tubes, meeting MIL specs, which are rejected for failure to comply with an individual equipment's special requirements.

One guided missile manufacturer, now expanding production, rejects about 90% of the tubes it receives. For individual tube types, rejection rates may be as high as 88%. Such rejection rates, which Avco believes are unduly high, would present the military with a serious problem in tubes under mobilization conditions.

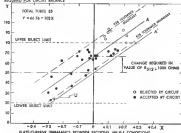
- Adjustment of MIL-spec performance requirements to reflect a universal need in the equipment industry for a certain tube type now is delayed. This is because the need for such change and its realistic description, as observed by special selection procedures in use.

All too frequently, Avco believes, the elaborate processing programs are substituted for an adequate engineering evaluation of the real cause of tube fail-out, and the necessary circuit redesign and/or tube requirements are thereby delayed.

Application Incompatibility

Procedures for obtaining tubes with special characteristics often obscure the basic cause of the trouble—marginal or

PERCENT OF POTENTIOMETER RESISTANCE REQUIRED FOR CIRCUIT BALANCE



ANALYSIS of high tube systems for failure to balance showed change of 1,000 ohms in value of stress motor would eliminate all but one reject.

wholly incompatible tube applications—Avco says. For example, in one missile guidance equipment, approximately two out of every three tubes of one type (from inventory rejected during production line testing were "good" tubes by MIL-spec criteria).

Two of the problems in this equipment, which accounted for 90% of the rejects, required that plate current in the two tubes of the tubes be balanced within much closer tolerances than provided by MIL-E 18. To compensate for this, a balancing potentiometer was designed into the circuit.

In order to provide for possible future changes in tube balance, it was required that the tube be balanced without using up the last 20% of the pot's travel at either end.

None out of 35 tubes from a randomly drawn sample failed to balance within this prescribed pot setting limit. However, inspection of the circuit design showed that by changing the tube to a group of tubes with the pot from 15,000 ohms to 16,000 ohms, all use of the rejected tubes would meet circuit requirements, with the loss of only one tube which previously had been satisfactory but would now fall outside limits (see sketch, above).

Does Service Pay Off?

Avco believes it has some other corroborating evidence that tube aging (however, whether with or without vibration, does not contribute to reliability of present MIL tube types, despite widely held views to the contrary. "In fact, stability," the firm points out, is more factors in the first few hours of tube

use, does not appear to be a characteristic of present MIL servicing tube types, Avco says, based on its considerable data.

That is some of the evidence Avco offers to support its doubts on the value of tube burn-in.

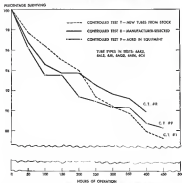
- Controlled Avco tests in 1952-53 on an identical tube type used in an airborne heading system showed no significant difference in failure rate on the first 400 hours between a batch of tubes drawn from stock without any preaging, another batch which had been pre-aged in the equipment and a third group which had been pre-aged and burned-in by the equipment manufacturer (see chart, p. 46).

- Wright Air Development Center in 1953 conducted tests on 15,000 MIL-type tubes to determine the relative merits of burn-in and burn-in with vibration versus none or the other aging. Two groups of tubes were operated under vibration for 48 hours, one group supported as tubes without vibration, the last group was not subjected either to burn-in or vibration.

The results of the tests showed no significant difference among the four groups (except in detecting drifts, aging or leakage). Burn-in, with or without vibration, did result in a slight improvement in the stability of such characteristics as plate current, transconductance and screen current, however.

- CBS-Hytron recently ran tests on two tube types, using a group of 1,000 6999C7's and 1,200 6AK7's. Each tube type group was divided in half. The tubes in the first half were tested,

**COMPARATIVE SURVIVAL DATA ON STANDARD TUBE TYPES IN
CONTROLLED TESTS: NEW TUBES FROM STOCK,
EQUIPMENT, AND MANUFACTURER-SELECTED TUBES**



ARMED TESTS to evaluate needs of tube borers show it provides little improvement.

files based at for 15 minutes, then selected, while those in the ground half were issued, placed on a shelf for 15 minutes, then selected. This cycle was repeated at the following intervals: 45 minutes, 2, 12, 24, 48, and 100 hours. "The company concludes "but that there is no justified difference in the percentage of 'acceptable' tubes for the types 6AN5 and 6899/CT" resulting from borers as compared to merely sitting on the shelf.

The Human Angle

In interpreting the results of its tests, CRS-1010 concludes that the human element plays in tube inspection and tests, plus variables in the test equipment itself, present an important part in determining the number rejected.

Anne agrees there are many intangibles in the variety of tube testing procedures and equipment used in use. That results in a lack of uniformity in test results from different graded missile manufacturers which leaves the tube makers in a quagmire, Anne believes.

The very nature of microscopic and X-ray tube inspection techniques, which appear to be gaining wide acceptance, are subjective and dependent upon the individual inspector, Anne says. At a

recently, one inspector may pass a tube which another would reject.

Anne is not at all sure that X-ray inspection, pioneered by North American Aviation, goes all the way to any large degree in improved tube and equipment reliability. However, in NAVA specifications, Anne Avianon. When first tube reliability has ceased to be a problem since the company put its microscope and X-ray inspection into effect.

Anne proposes to conduct a carefully controlled test run on two batches of tubes to evaluate microscopic and X-ray (MAN) inspection. One group would consist of tubes which had passed MAN inspection, as well as MIL-E-18 tests. The second group would consist of tubes which had not been subjected to MAN inspection, but which had passed MIL tests.

A further subdivision of the first group may include tubes which had passed the MAN inspection, but do not pass MIL tests, in an attempt to see if there is any correlation between the visual acceptance criteria and performance.

NAVA has volunteered to cooperate in such an evaluation program. By spring, Anne hopes to have sufficient tubes to outfit K-type bombing systems in a number of B-47s. A similar evalua-

tion test is planned for AN/ARC 27 UHF communications sets in Navy use only.

If these tests show a positive correlation between tube life and the results of MAN inspection, then visual inspection techniques should then be considered for inclusion in the basic MIL-E-18 spec, Anne says, used equally effective tests can be developed for use by the tube manufacturer.

Scott observes questions whether tube performance tests can detect defects from which now show up only in microscopic and X-ray inspection. Raytheon, which recently started using a 100,000 volt X-ray to inspect its tubes, says that it has "detected ray flaws in the welding of certain anode pins which, once under a powerful microscope, appeared to have been perfect."

Difference of Opinion

Some missile equipment and graded missile manufacturers may take issue with a few of Anne's views. For example, in a recent symposium on reliability sponsored by the USAF and Radio Corporation of America, RCA pointed the results of its progress to improve the dependability of the ARC-119 transmitter. These results suggest that tube borers do not pay off.

Prior to introducing special tube processing, ARC-123 suffered tube failures at the rate of 14% per 1,000 hours during a 40 hour operation run in test. After special processing was introduced, the failure rate dropped to 1.5% per 1,000 hours. (The RCA processing consists of a 40-hour burn-in, 100-cycle heater test at elevated temperature, microscopic inspection and 100% test of electrical characteristics.)

Following the 40-hour run-in, the equipment is subjected to operational and quality control tests, then accepted for insertion 125 hours. During this 125-hour run, tube failures have dropped from 9% to about 0.5% since the processing was introduced, RCA's R. D. Baker reports. However, a variety of other manufacturers, who are expected to improve ARC-123 reliability, may also have contributed to improved tube performance, making it difficult to pinpoint the contribution of each.

It is in fact an equally confusing evidence, in the test of various types of tube test procedures, that Anne has proposed that the Defense Department authorize a comprehensive and scientific evaluation under carefully controlled conditions. From such a program it will be possible to definitely establish which procedures contribute to tube reliability and incorporate these into the MIL spec. Those first contributors will be, as Anne put it, tube life because of frequent handling, can be dropped, saving industry's time and the taxpayer's money.



you can achieve

BULL'S-EYE POSITIONING

WITH THIS SCREW THAT ROLLS ON BALLS

Pin-point positioning is possible with an ARROW Ball-Screw mechanism even under the most adverse temperature conditions. Because Arrow Ball-Screws move entirely on friction-free steel balls, they permit an assembly to move effortlessly and in position exactly at the desired spot... with no springiness, no drift, no rebound. Because they require no lubrication, they allow you to operate in high-temperature areas without fear of fire and flammable gas, and in low-temperature areas without the problems of stiffened grease and sluggish operation.

Because Arrow Ball-Screws are friction-free, there are no greatly increased drive efficiency, allowing you to save on motor size and weight, first cost, space and electricity required.

Arrow Ball-Screws are at work now in many varied applications. They have proved to be the best answer to many design and operating problems. They may solve a problem for you. To get more information, write for our free booklet.

Cleveland Pneumatic

Tool Company ESTABLISHED 1890

DEPARTMENT G-101

AIRCRAFT GROUND HANDLING EQUIPMENT
BALL-SCREW MACHINING • AIR-DRIVE IMPACT ACTUATORS

WORLD'S LARGEST MANUFACTURER OF AIRCRAFT LANDING GEAR

Opportunity for Qualified Engineers

Would you like to work where the future is so long and bright as the future of the aircraft industry? Where vacation and retirement benefits are among the world's best in the industry? Where day employees share in the profits of the Company?

If you are qualified for one of the jobs listed below, you owe it to yourself to talk with the people at Cleveland Pneumatic... a 60-year-old company managed by men with vision and enthusiasm.

JOBS

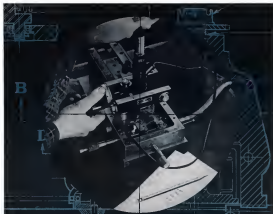
**are now open
for**

- **Stress Analysts**
- **Design Engineers**
- and
- **Design Draftsmen**

Send resume stating education, experience, and salary requirements to:

**Industrial Relations Department
Cleveland Pneumatic Tool Co.
2101 E. 72nd St. • Cleveland 5, Ohio**





Little things that make PERFECTION

America's fighting planes depend on many little, extremely precise elements to define their key parts. In GECCO Turbo-axial Engine Controls, vital timing parts are held to closest tolerances; sections are finished in 2-4 micron surface. Assembled and aligned with toll-free exactitude... many of them done completely under specially designed, large-size, high power microscopes... these mechanisms control fuel flow with the precise sensitivity essential to optimum performance.

Have to GECCO are the engineering abilities... men honing know-how and equipment... the attention to little things... that bring perfection always closer.

GECCO

CHANDLER • EVANS

WEST HARTFORD 1, CONN., U.S.A.

PRINCIPAL PRODUCTS OF
JET ENGINE FUEL CONTROLS • AFTERBURNER CONTROLS
PUMPS • TURBOINTEGRATORS • EXHAUSTORS • PROTECTOR PLUGS

Avionics Companies Open New Facilities

National Aeronautical Corp. (Nac) will build a new \$250,000 plant in Airlie, Pa., to house its engineering, office and manufacturing operations. The new plant will have an annual production capacity of 515 fuselages, approximately five times the amount of the first 1955 plant.

Other recently announced expansions at the various plants include:

• **Navstar-Katco Corp.**, New York, has established a Vehicle Division in Garden City, Calif. The division includes a second plant in nearby Hawthorne, providing 50,000 sq ft of facilities for engineering, development and manufacturing of precision vehicles and other remote devices. Division is headed by Mr. Arnold Rabin.

• **Roscoe Laboratories**, Riverside, Calif., maker of precision gels, has opened a Midwest subsidiary plant in Ames, Iowa. The sports a 100,000 sq ft, 11,000 sq ft of space in the Whitcraft Bldg and employs 15. Arthur J. Miller has been named manager.

• **Compaco Measurement Corp.**, North Hollywood, Calif., is the new name of the former Compaco Measurements Division of Detrolite Corp., recently acquired by KC Controls Corp., North Hollywood. The new company is located at 1457 Clason Ave.

• **Timely Instruments & Controls Corp.**, has established its new facility at 1045 West 115th St., Gardena, Calif. Company, headed by Milton Schickel, makes electronic instruments and computer equipment.

• **Electronic Engineering Co. of California**, Los Angeles, has added 6,500 sq ft of engineering office space to make its total area to 75,000 sq ft. New facility is located at 181 So. Alameda, directly across from the plant.

• **Tecan Instruments Inc.**, Dallas, has opened a new Eastern region marketing office at 508 Fifth Ave., New York, New York.

Avionic Bulletins

• **Instrument Building Methods**, detailing all aspects of complete electro-mechanical control systems using computer components, are described in 14-page bulletin. Available from Corp. of America 20 to 20th Century, New York Park 1, N. Y.

• **Control System**, describes the general measurement and dynamic range of 275 up to 4,500 cps, are described in Control System 107. Also lists of air flow and static pressure transducers covering 0.4 to 100 mm, are described in Control System 108. Available from 145 Hawthorne Rd., Hawthorne, N. Y. 10647.

• **There Is No Substitute For Experience** is the title of 12-page brochure outlining computer and Bulletin 100 electronic data and development programs in the 10-month training of National Aeronautics Corp. Address: 100 National Ave., Dayton, O. 45433.

70777 FILTER CENTER 333333

• **New Type ADF Cores**—New non-blending cores which reportedly will boost automatic direction finder performance in the presence of atmospheric noise, are soon to be developed to permit their use in civil ADFs now under development. Research in that industry is underway in civil ADFs as replacement for old World War II models now in use.

• **Navstar Expands Its Line**—Navstar is expanding its Synapse line of active electronic aircraft type mission equipment which it launched with the Model 1001 Synapse, containing equipment. The firm now will market its Model 1016 YHF communications set, consisting of a 500-channel semi-conductorized receiver, covering the 105 to 135 mc band and a 90 to 160-channel transmitter, both with 50 kc channel spacing. Navstar also is developing a VOR receiver navigation adapter for use with the receiver.

• **New Cold Cathode Emitters**—A new type of high-power (megawatt) cathode which utilizes electron in the presence of a high-powered field, eliminating the need for a filament heater, has been developed by the Physics Dept. of Hartford College, McMillanville, Conn., under contract to the Office of Naval Research. New cold cathode has de-

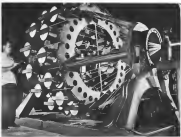
livered up to 20 amp. at a peak power of more than one megawatt under pulsed operation. Development of a similar cold cathode for CW use is under way. Navy says the new type cathode can be as important to high-power tubes as the transistor to lower-power devices. Dr. W. P. Duke of Hartford, directed the project.

• **SPARs Go South**—Laboratory for Electronics has delivered two of its SPAR precision approach radar to the Navy for use in Operation Deepfreeze, the new Arctic ice exploration, under command of Rear Adm. Richard E. Byrd. The SPARs will be used to guide CGA approaches on Polar landing trips.

• **KLM Boost British Autopilot**—The Smith S.E.P. 2 autopilot unit has been selected by KLM for use in its fleet of Viscount 800s being set up in U.S. competition. The autopilot unit includes automatic approach computer, automatic climb rate and horizontal altitude control.

• **Fast Cathode Radio Gels**—Dellco Air Lines has become the first carrier to buy the new Cathode Channel weather radar. The carrier's officials say they plan a further radar installation.

• **Flash ADF Sense Antenna**—Douglas Aircraft Co. is working out a dual flash antenna installation of Bendix LP-70 flash ADF loop antennas in which the sense antennas will be incorporated in



Machine Forms Avionic Cables

New planar cable forms variety of shielded wires, coaxial cables, and power leads into a single stranded cable to use in aircraft and missiles. Developed by Douglas Kuehn, Inc., the device can handle large-scale or short-run production. Company's address: 1200 So. Figueroa St., Los Angeles 7, Calif.

Now!... the **NEW** **DIAGONAL** **GRIP-HEAD**

ROBINSON WIRE TWISTER

Feeder, more efficient than used. The new, distinctive **DIAGONAL GRIP-HEAD** is designed especially for those users, hand-to-mouth pliers. Fully-mounted wire-line action wire-twister 3 inches in size (weight) for use by any other method... even in space as small as 1/160 per inch assembled.

3-TOUCH-IN-1 pliers-cutter, wire-twister, hand line-twister, bronze bearing. No adjustment. Tensile lock on wire, can't slip off. Fastest, safest, most every time.

12"...the assembly line... **\$21.50**
6"...the bench work... **\$20.50**

Don't miss it! Write: **RALPH C. SCHMIDT CO.**
Beverly Hills, California 90212
301 AIRWAY DRIVE WYOMING

Opportunity for the holder of a production-item patent!

A large manufacturing plant equipped with precision machinery will finance and manufacture, on royalty basis, patented production items. If you have such a patent, and are interested, write:

PATENT PRODUCTION DEPT.
3330 W. TEMPLE STREET
LOS ANGELES 36, CALIF

the same housing which encloses the lamp elements. The new design is expected to eliminate much of the drag that is prevalent in older ADF antenna installations.

► **Y-Shaped Stick for Right-of-Way**—With the increasing number of overhauls, publications, and controls being mounted on the control stick in a modern installation, there is little room left for the pilot's hand. Some designers say the solution is to provide a Y-shaped or U-shaped control stick. Switches and controls used during take-off, cruise, and landing, might be installed on the left side of the "Y," while those needed during instrument-conditions could be mounted on the right side. Even the throttle control itself might be placed on one or the other. Pilot would then fly with both hands, one on each of the branches.

► **New Target Seeker—Self Aircraft** has developed a new very small, lightweight prototype target seeker which senses electromagnetic radiation of any frequency. New device could also be used in helicopters or lightplanes to permit bombing an ground target in a ground radar.

► **Private Casemetry**—During recent press tour of Hughes Aircraft Co. labs and factory, each member of the tour received a free Regency transistORIZED



portable radio (with private telephone) to the new power and transmitter connected to the guide's chest radio. The transmitter and its battery supply were mounted on a gold cart and ejected around by an antenna. This enabled visitors to hear the guide's commentary despite factory noise, and to point at points of interest without losing voice contact with the guide. And a private car a bit on their electronic capability, Hughes built a steady transmitter into each car, placed space batteries along the tour route, and car and space receivers. To permit voice between touring parties, each transmitter operated at a different frequency.



Center Speeds UAL Message

New telegraph message switching center put into operation by United Air Lines at New York International airport has at least the capacity of UAL's previous switching center at LaGuardia Airport. Messages from 17 of United's stations are channeled into the new center, from which they are relayed immediately to their destinations without stopping, simply by pressing a button. Messages are typed at point of origin only and are produced as printed form at destination. The New York switching center, one of six in UAL's \$3,000,000 private telegraph network linking 210 stations, also incorporates a center-message transmission device which allows in operation to send a message and instantly to any combination of stations by merely pushing station buttons. UAL's network carries 3 million messages a month.

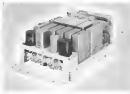
Meet Your Air Arm Man With The Facts, A. D. Foster

At Foster serves the New York and New England areas. Through him, or one of his counterparts in your area, you can get all the facts on how Westinghouse Air Arm has bridged the critical gap between radar fire control and automatic flight control.

Contact Al at 40 Wall St., New York, N. Y. Telephone: WHitfield 3-4321. In other areas, for the name of your Man With The Facts, contact Westinghouse Electric Corporation, Air Arm Division, Friendship International Airport, Baltimore 27, Md. Telephone: LIttleton 1900. Learn how the...



New radar coupler links flight control to fire control



This new coupler makes it possible for the automatic flight control system to take viewpoints directly from the fire control system and by the interrupter to the target for an automatic hit.



The gun camera and, to check accuracy of the combination of radar gun sight, coupler and flight controls. Camera is zeroed to make trajectory (figure cross) record of gun-sight performance. PHOTO: A.

NOW . . . Read more facts about this important new development —>

YOU CAN BE **SURE**... IF IT'S
Westinghouse





A Lockheed F94C Starfire interceptor using the new radar coupler fires a double salvo of rockets from wing pods.

New radar coupler links flight control to fire control

During the all-important few seconds that constitute the mission—from lock-on to knock-down—the new Westinghouse W-3A radar coupler takes over.

The coupler frees the pilot for other flying duties at the critical time, channels human response into an air-to-air interception and gives far greater likelihood of success for the mission. After the radar operator locks on the target, the pilot switches to automatic intercept. Then—the flight control system takes command signals from the W-3A Radar Coupler to automatically fire the rockets and destroy the enemy.

If the target should be lost after lock-on, due to evasive maneuvering, the system automatically reverts to straight and level flight, allowing the radar search to be resumed.

The coupler may be adapted to any fire control system and Westinghouse radio-type flight control.

Eighty-six Westinghouse test flights were made during the development. During the 90-day operational suitability tests at Eglin Air Force Base, the coupler and flight control system experienced 100% availability. It has passed all environmental tests.

This coupler and parallel developments in airborne electronics at Air Arm are constantly advancing the state of the art . . . helping you bring tomorrow's aircraft . . . One Step Closer. For aid with any of your developments related to the Air Arm Systems Family, contact Westinghouse Electronic Corporation, Air Arm Division, Friendship International Airport, Baltimore 27, Md. 21084

THE AIR ARM SYSTEMS FAMILY

Fighter Armament	✱	Special Purpose
Missile Guidance	✱	Flight Control
Bomber Defense	✱	Systems Components

YOU CAN BE SURE... IF IT'S

Westinghouse



ROHR

IS THE
WORLD'S LARGEST
PRODUCER OF
READY-TO-INSTALL
POWER PACKAGES
FOR AIRPLANES

but that's only part of the Rohr Story

ROHR has won fame for becoming the world's largest producer of ready-to-install power packages for airplanes like the all-jet Boeing B-52, the Douglas DC-7 and other great military and commercial planes.

But the whole ROHR story is an millions of parts, far in addition to power packages. ROHR builds over 30,000 other different parts for strength of all kinds.



ROHR
AIRCRAFT CORPORATION

CHULA VISTA AND RIVERSIDE, CALIFORNIA

When you want aircraft parts better, faster, cheaper... call on ROHR and the ROHR engineering skill and production know-how gained from building thousands of power packages—and millions of other aircraft parts.



Thunderflash Patrol

Five RF-4D supersonic reconnaissance planes are shown here in first flight formation plays of the Thunderflash to be released. "Droop" horizontal tail allows plane to fit inside bomb bay of GRF-36 aerial carrier for long-range missions.

WHAT'S NEW

Telling the Market

1956 Caudron Reference File of Aircraft Photos and Specs, booklet, Infalite Co. Div., Green Glade and Carbon Corp., 100 Madison Ave., New York 17, N. Y. ... Top Controls—electric two-hand clutch controls for industrial machines, Corbin 15 Motor Switch Div., Minneapolis-Honeywell Regulator Co., Farquhar, Ill. ... High Vacuum Furnaces for melting, heat treating, annealing, brazing, degassing and production of castings and alloys, Corbin 152, High Vacuum Equipment Corp., 349 Lincoln St., Hingham, Mass.

Aggratus Dugout No. 3 directory directory apparatus and equipment, including mobile air conditioner, liquid cooler, portable refrigeration systems, flexible heating tapes, vacuum control instruments, ballasts, A. Dugout & Co., 139 W. Kinross Ave., Chicago 10, Ill. ... A Guide to Selecting an Ex-

hausting Fans, booklet, Teller Co., Butler, Pa.

Combination 6 and 12 volt testing and servicing equipment, folder, Allen Electric & Equipment Co., 2108 N. Pitcher St., Kalamazoo, Mich. ... Canas explosion valves catalog, Canas Corp., 1511 Shoshone Drive, Buffalo 21, N. Y. ... Ball bearing screws and ball bearing splines, catalog, Supreme Steering Gear Div., General Motors Corp., Saginaw, Mich.

Applications of Marbond bonded sand-wich structures to Martin's XF4M-4 multi-jet airplane, 16-page color manual film, available on loan from Glenn L. Martin Co., Propulsion Section, Mail 75, Baltimore 3, Md. ... Use of Light Waves for Controlling the Accuracy of Block Gages, book, Tague Equipment Co., 411 S. Dearborn St., Chicago 5, Ill.

Double-Active Straight Side Presses design features and improvements, Series D Catalog, Daily Machine Specialties, Inc., 2300 S. Lawrence Ave., Chicago 30, Ill. ... Lower Manufacture

ing Costs shows how a nondestructive testing program can be installed in production departments as a money saving tool, booklet, Mapadex Corp., 7405 W. Lawrence Ave., Chicago 31, Ill.

Fabricating silicone rubber parts for industrial needs, booklet CDP-673, The Plastics Story describes new silicone compression and injection molding facilities, booklet CDP-673, Plastics Dept., General Electric Co., 1 Plastics Ave., Pittsfield, Mass. ... Operation and application of Newline Ekl Rotameters, Type 12112 frequency meter, folder, Electromech De., North American Philips Co., Inc., 750 S. Fulton Ave., Mount Vernon, N. Y.

Free Machining Tool and High Speed Minder, first edition, detailed information on analysis, and factors, aluminum, stainless, titanium, steel, tooling and availability of tool and high speed steel, Allegheny Ludlum Steel Corp., 2820 Oliver Bldg., Pittsburgh 21, Pa. ... Mechanical pressure, airframe and aircraft-mechanical carbon and alloy steel forgings, catalog,

CHOU FOO LING

was born too soon...

Back in 1937 AD the inventive Chou Foo Ling
discovered the potential of Rockets as a source of
power. He attempted to gain extra acceleration
by attaching rockets to their sleds.



he was seeking "Superperformance"



Alas, Chou Foo Ling's experiment was a dud,
even though he had the right type of power-
source for superperformance.

Today, Mr. Jet Pilot can have extra power-
ful rocket power—at his fingertips, thanks to
recent important technical achievements at
Reaction Motors. He can turn his RMI rocket
auxiliaries off or on at will for steeper and
faster climbs, higher operational altitudes, or
greater maneuverability and speed.

At RMI's new modern plant, an integrated
team of rocket specialists are putting the
"super" in today's aircraft performance...
constantly conquering the frontier of speed
and space.

Speakeading Progress through Research



Career opportunities available for experienced mechanical,
aeronautical, electrical and chemical engineers, physicists,
chemists. Send complete resume to employment manager

REACTION MOTORS, INC.

Denville, New Jersey

Affiliated with OLIN MATHIESON CHEMICAL CORP.

Ohio Scramble Tube Div., Copperweld
Steel Co., Sheffield, Ohio

Aircraft Catalog No. 108 includes
information on fuel system planning,
selection and installation of flexible
line items, straps and self-sealing
couplings. Aeronaut. Corp., 390 &
East Ave., Jackson, Mich. Auto-
matic Screw Machine Products, Bulle-
tin, ASME Div., Harvey Aluminum,
7320 S. Western Ave., Tempe, Ariz.

"Fastest Metallurgy", bimonthly
publication of Bantam Metallurgical
Corp., North Chicago, Ill. Tool
holders for three-way outside inserts,
Casting CT 293, Carborundum Div., Car-
borundum Co., Detroit 37, Mich.
PS line of battery-powered trucks, Bulle-
tin 1572D, Brite-Racing Co., Cleve-
land 3, Ohio

Publications Received

• Across the High Frontier—Wil-
helm R. Lindgren—Pub. by William
Moros & Co., Inc., 425 Fourth Ave.,
New York 16, N. Y. \$5.75, 280 pp.
Story of test pilot Charles E. Yeager.

• 208 Miles Up—The Conquest of
Upper Air—Second Edition—by J.
Gordon Vard—Pub. by Ronald Press
Co., 15 East 56th St., New York 10,
N. Y. \$5.00, 281 pp. Information
about the progress of the upper air
research program in the United States.

• British Civil Aviation—by D. C. T.
Harris—Pub. by John de Graft, Inc.,
64 West 3rd St., New York 10, N. Y.
\$1.00, 144 pp. Photos and sketches
of British civil aircraft and brief
biographies of operating companies.

• World Airline Record, 5th Edition,
1955—Pub. by Bowles & Associates,
127 So. LaSalle St., Chicago 4, Ill.
\$2.75, 96 pp. Traffic & financial reference of
209 scheduled airlines.

• Fifty Years at Farnborough—Prepared
for the Ministry of Supply by the
Control Office of Information—Aero-
naut. Agency British Information
Services, 30 Rockefeller Plaza, New
York 10, N. Y. 354 (plus 5c postage
and handling), 16 pp. Brief history of
the Royal Aircraft Establishment and
its predecessors.

• Rockets—by Cape R. N. Lupton
and J. D. Woods—Pub. by Butter-
worths Scientific Publications, 38
Knapp, London, W. C. 2, England.
\$4.45, 160 pp. Introduction to the
theory and practice of rocketing sci-
ence.

STOP



**ALL-WEATHER
THRUST
REVERSER**

BY...

marquardt  **AIRCRAFT CO.**

Van Nuys, California

THE WEST'S LARGEST JET ENGINE RESEARCH AND DEVELOPMENT CENTER

BUSINESS FLYING



RATO INSTALLATION is mounted on Rockwell PV-1. At night, Aeroquip DC-3 shows on two external units, with one prop windmilling.



RATO UNIT—Rapid detector of PV-1's radar (left) is glass-plastic tube. Twin Rotas on Aeroquip's DC-3 use 15 KS 1800 units.



New Unit Starts Trend Towards Rato For Business Aircraft

By Erwin J. Buthus

A trend towards installation of radar alert/taxi powerplants on business aircraft has resulted from pilot interest in the safety aspects of Aeroquip General Corp.'s 1,000-lb. direct installation Rato recently released for civilian use by the U.S. Navy. Initial indications of the trend.

Several hundred installations of the standby powerplant will be carried by U.S. and Canadian corporate aircraft within the next two years, the Rato manufacturer told Aviation Week. G.E. Rot, commercial sales manager, and approximately 45 corporations and airlines were on the books prior to the first public demonstration of the Model 19KS 1000 Al Rato during the National Business Aircraft Assn. forum in Detroit (AW Oct. 17, p. 18).

A junior version of the 19KS 1000 Al, developing 250 lb. thrust and weighing 42 lb., is expected to be certified by the Civil Aeronautics Administration within next to twelve months for installation on aircraft ranging from the

Boeing Bonanza to the Aero Commander.

Standby Power

Business pilots are interested in the Rato units because of the standby power instantly available should an engine cut on takeoff and because of the power boost it provides for taking off fully loaded from marginal airports of high elevation or on high-temperature days. Aeroquip reports that the 19KS 1000-Al will reduce takeoff distance up to 50%.

In a demonstration of its own DC-3 fitted with two Ratos under the belly, the Aeroquip pilot chopped the right engine at V_R on a main road takeoff and permitted the passenger to wind-aid. The aircraft approximately 200-ft. altitude at 4,000 ft. from start of takeoff and was going 35 mph faster than he would have been with the engine dead and no Rato. The aircraft's gross weight was 25,000 lb. Aeroquip noted that without Rato it would have taken approximately 5,000 ft. to achieve this altitude.

Nose level inside the cabin when

the Rato fired off was about half that of a T-51 jet trainer. The pilot and no unusual flight characteristics were noted in the use of Rato.

The current Aeroquip-General 19KS 1000-Al submodel Rato, bearing CAA Type Certificate 249, produces 1,000 lb. thrust for 15 seconds. It is approved for operation and storage within a temperature range of -65 to 145°F and to 15,000 ft. altitude. Standby installed life is 500 hr. at sea level, whichever



MAITER AND PRIME Rato engines are centered on Aeroquip DC-3 panel.

Aeroquip

ANNOUNCES THE

BIG

NEWS
IN TEFLON HOSE!

See Next 3 Pages

Years Ahead! Detachable,

Leakproof "super gem" Fittings

(PATENT APPLIED FOR)

and 666 Teflon* Hose

ASSEMBLE QUICKLY, EASILY WITH ORDINARY BENCH TOOLS!



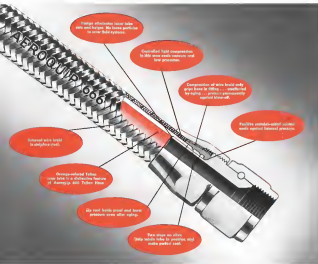
Assemble a new "super gem" fitting. Seconds of supply, slide, and seal. Fitting is assembly is in this order over the hose.



Next, the hose is pushed by hand into position between the Teflon inner tube and the wire braid.



Assembly is completed by covering the sleeve into the outer using an ordinary AM wrench.



"super gem" is an Aeroquip trademark.

Aeroquip

AEROQUIP CORPORATION, JACKSON, MICHIGAN
AERO-COUPLING CORPORATION, BURBANK, CALIFORNIA
AEROQUIP (CANADA) LTD., TORONTO, ONTARIO, CANADA

LOCAL REPRESENTATIVES IN POLAND, GERMANY, AND AUSTRIA - AEROQUIP PRODUCTS ARE FULLY PROTECTED BY PATENTS IN U.S.A. AND ABROAD

"super gem" FITTINGS WILL NOT LEAK EVEN AFTER HIGH TEMPERATURE AGING. Unlike conventional swaged or crimped fittings, the "super gem" fitting does not hold the hose by compression of the Teflon inner tube. There can be no loss of compression due to the cold flow characteristics of Teflon with resultant leakage at proof pressures.

"super gem" FITTINGS SAVE WEIGHT. Available in steel, stainless steel, or aluminum, "super gem" fittings offer significant weight savings, particularly in the larger sizes.

ELIMINATE EXPENSIVE, HEAVY ASSEMBLY OR SWAGING MACHINES. A vice and a wrench are the only tools needed to assemble 666 hose and "super gem" fittings.

SIMPLIFY ENGINEERING MOCK-UPS AND PRODUCTION CHANGES. Development and production engineers have complete freedom in making changes, even on the production line. New hose lines can be made in minutes. Scrap costs are kept to a minimum because end fittings on assemblies can be reused and hose salvaged.

REPLACE HOSE LINES QUICKLY IN THE FIELD. Simple assembly of 666 hose and "super gem" fittings makes field replacement easy. Minimum inventories of bulk hose and fittings are required for field storage.

666 TEFLON HOSE IS DESIGNED TO AEROQUIP'S EXACTING SPECIFICATIONS. Distinctive orange-colored inner tube provides positive identification. Operating temperatures are -100° F. to +500° F. Sizes and pressure ratings are suited to all engine and airframe fluid systems.

*Du Pont Teflon is for its trademarked name.



Aeroquip Bulletin AEB-9 Gives Complete Technical Information and Test Data

Fill in and mail the handy coupon on the next page

Aeroquip

REG. U.S. PAT. & TM. OFF.



SWIVELS 360°

ADJUSTABLE ELBOW FITTINGS Simplify Hose Line Installation

Aeroquip "super grip" Adjustable Elbow Fittings can be loosened and rotated to the exact position required as the hose assembly is installed. They are then tightened in position. This adjustment has absolutely no effect on the grip of the fitting on the hose. There is no danger of hose twist. Ordering is simplified.

Aeroquip Corporation,
Jackson, Michigan

Business:

Please send me your Bulletin AEB-9 on Aeroquip "super grip" fittings and 666 Helco files.

Name:

Company:

Address:

City _____ State _____



FILL IN AND MAIL THIS COUPON TODAY FOR AEROQUIP BULLETIN AEB-9

Get complete technical
information and test data
on Aeroquip 666 Hose
and "super grip" Fittings!

comes first. Maximum storage period is two years.

Cost of each bottle including shipping is \$300. Because of the delicate and time-consuming inspection first would be required to check the integrity of the casing after the firing, the company does not refill the containers.

Installation Costs

Initial installation costs for a test unit on a DC-3 will be between \$7,500 and \$10,000, including pilot checkout before. Aircraft arm that it will handle external installation blow-ups at cost and supply money of loan when the contract can have its expense fitted. The aircraft in which the bottles are attached is designed to take 4,500 lb thrust. Fully loaded, the installation weighs 340 lb. A single bottle hook-up for a Two-Stroke would cost about \$5,500.

Installation also can be internal. First business plan to take the new installation unit was Borel's Manufacturing Corp.'s Lockheed PV-1, which has three 1985-1990 A's lined into the belly.

This design was noted out by Aeroquip Engineering Service, Burbank, Calif., and installed by Pacific Aerospace Corp., Burbank. The Rate meter recommends submerged Rates for the

Veritas, B-27 and B-76.

Aeroquip-Glenn Corp., Azusa, Calif., reports that about 15,000 Rate units have been fired in military service and in other applications without a single malfunction. The CAA has conducted the standard, government at the same time as an effect engine duration being the only limiting factor, Rate told Aviation Week.

PRIVATE LINES

Shell Oil Co., Tulsa, Okla., plans to purchase a north de Havilland Dove executive transport. It recently purchased its 50th. Coast Community Builders Aircraft Sales, Dallas, Tex., reports nearly 80 Doves are now in service in the U. S., primarily as business planes.

First business under one roof and an administration building to handle business aircraft will be built by Aeroquip Aviation Service Division, Garrett Corp., on a 25-acre site at Los Angeles International Airport, Calif. The project, designed by Aviaide Aviation, a subsidiary, will cost \$600,000. It is scheduled for completion in January.

Grammer Goose amphibious conversion, noted at Boeing's plant's performance by 10% is being completed by Don H. Pundlich Aviation Enterprises, Torrance, Calif. The Super Goose wings will be clipped by 15 in and squared off. Other features: Wing-mounted floats, windshield, dump valves on fuel tanks to increase gross weight by 500 lb., high-type pressure carburetor and electrically operated landing gear. Flight tests of the prototype conversion are expected this month.

All-weather work play for business aircraft is being marketed by AC Sport-Play Division, General Motors Corp., Flint, Mich. Designed 1985-86, will have a seat and controls with the engine jacket as the play's inside, to prevent leaks of moisture and foreign matter.

Two-position propeller for personal and business planes built by McCauley International Corp., Dayton, Ohio, has been approved for Cessna 171A and 170B. Power features of the new prop are said to be necessary to enable propellers to fly up to 10 mph at 6,000 ft altitude, compared with fixed pitch units. In climb it is stated to increase performance 12% at sea level to 60% at 10,000 ft. Now two-position Merit-Mate's price is \$495.

Leasair Mark 2 avionics is offered Lockheed Lodestar owners who seek the Leasair's 260-250 mph cruise speed and over 2,500 mi range without disturbing existing interior and other general characteristics. Lear Aircraft is providing. The new, Super Mustang, Calif., which developed the Leasair Mark 2, notes that its new Mark 2 will meet air transport category lower requirements.

A new Licensing G80-460 ground-and-aircraft engine has been approved by the Civil Aviation Administration under Type Certificate No. 254. The engine's 415-hp engine develops 140 hp on takeoff and 120 hp normal. It is installed in the new Super Aero Commander 680 light transport (AW Sect. 74, p. 101). Several other manufacturers of small executive transports are also expected to use the new powerplant.

Shipment of 311 utility-business planes in the new 10-pitch category during September was made by an U. S. company. The total selling value was \$3,944,083. January-September total 3,528 planes worth \$50,867,000. September shipments by company: Aero Design, nine; Beech, 44; Cessna, 95; Mooney, 6; Piper, 152; and Taylorcraft, 1.



Build-It-Yourself Helicopter-Glider

Designed especially for water sport enthusiasts, the new Borel Helco-Glider helicopter is also said to have commercial applications. One suggestion: Use it behind a fishing vessel to spot possible catches. The Helco-Glider is shown during a flight by its designer Ivo Borel at Cypress Gardens, Fla. Borel Aircraft Corp., Box 2725, Raleigh, N. C., says it will sell the Helco-Glider with a ready-to-fly form as well as a build-it yourself kit. Construction plans also will be made available to amateur builders.

AVIATION WEEK, November 28, 1995



SILASTIC seals B-47

access openings... keeps them operational at temperature extremes



Mail coupon for complete information on SILASTIC

Bow Corning Corporation
Midland, Mich., Dept. 90114

Please send me your
NEW PAMPHLET ON SILASTIC

NAME _____

COMPANY _____

ADDRESS _____

CITY _____ STATE _____ ZIP _____

DOW CORNING
MIDLAND



CORPORATION
MICHIGAN

Circle 12 on Reader Service

NEW AVIATION PRODUCTS

Electric Work Tower

Hydroelectric elevating work tower for aviation use is powered by a 3 hp. single phase electric motor. The MIL-4 AC Motor-Lift can be plugged into any 110V A.C. outlet. The motor operates a hydraulic pump to raise the work platform from 7 to 17 ft above the floor in 24 sec. Working capacity is 400 lb.

The plug is tower is provided with 20 ft. of heavy-duty extension cable, permitting work along a 100 ft. strip before moving to another outlet. Battery and hand-operated models are self-contained and can be used anywhere. Safety Steel Product, Inc., 5234 W. State St., Milwaukee 17, Wis.

Locking Cargo Tie-Downs

Cargo tie-downs, and in the Dodge L-124 and the Fairchild C-119 can provide weight reductions of approx. 50 and 78 lb. respectively. In the Model M-1 for 99,000-lb. service, the chain is automatically locked into position as it is inserted into the slot. The release mechanism permits the chain to be released easily even under tension of 5,000 lb. Tie-downs can be load-fastened to loads of 500 lb.

The basic and three-pocket of the M-1 are constructed of forged, heat-treated alloy steel and are steel-plated with polyethylene positioned to shield aluminum corrosion protection. Eastern Aircraft Corp., Dayton, Ohio, Pa.



Aluminum Alloy Plane Track

New lightweight high strength TOST aluminum alloy track and component fittings, handle 120 loads and were designed specifically for high-density parking modifications, gully trails, ramps, banks, kites, one-way, cargo tie-down and parking. The new track also offers a 20% weight reduction over previous materials, the metal chain.

Track component fittings such as cargo tie-down rings, slot fittings, strap fittings and gully fittings, are available in either a locked position or free turning type.

Bowman Corp., 141 N. Rockhill Road, Beverly Hills, Calif.

Circle 13 on Reader Service

Radiation Exposure Dosimeter

Exposure dosimeter for neutron detection and visible measuring of dangerous exposure to radiation is the use of a ball point pen and consists of a hollow, hermetically sealed ionization chamber enclosing polystyrene beads which serve as indicators of the amount of exposure to X-rays or gamma rays.

Model 120 Radial is calibrated to detect 50-mrem exposure, which is 1/4 of the amount of radiation which the average human being can withstand, the marker says. The 50-mrem dosage may occur over a number of hours or as a single exposure change. Special models can be calibrated to particular neutron setups to meet specific requirements.

Electronbeam Co., 416 S. Hollywood Way, Burbank, Calif.

Indicating Flowmeters

New flowmeters feature a direct flow design which indicates a flexible venting method flow in indicate flow on a relatively acute changing component parts such as joints, bearings, ball valves, diaphragms.

Model L uses a direct reading scale. Pressure drop across the meter can be as low as 4 in. of water, permitting its use on very low flow rates of gas.

Model LP is fitted with a transparent cover to permit visual inspection of the liquid or gas flow. It can be built for any pressure that are contained safe for the transparent cover. Transparency can be damaged and made to withstand pressures of several thousand pounds under moderate pressure. Instrument Div., South-East & Co., 1911 S. Redwood St., Chicago 8, Ill.

Tool Bonds Stainless Tubing

Exact tube header in a compact, crank-operated, screw-gas device for one manual bending to exact tolerances. It will handle standard or 18 cold drawn stainless steel tubing. The unit is designed to produce bends up to 180 deg. in one continuous operation without stress or fatigue.

Operating mechanism consists of a crankshaft driven by a hand crank, which is bolted and hardened steel work with ribs of 50 to 1, supported with galvanized ball bearings and a ball-bearing thrust bearing.

Slide block has grooves for as tube sizes 1/4, 3/8, 1/2 and 3/4 in. O.D. The crank handle which operates the handle is also used to adjust the slide block score.

The header can be changed in a bench vice or mounted on an adapter bracketed to a work bench or to a standard support base.

Tube & Hose Fittings Div., Parker Appliance Co., 17125 E. 48th Ave., Cleveland 12, Ohio.



One-Man Pallet Dolly

Pallet dollies of all capacities construction provide maximum strength at minimum weight for easy one-man handling.

The units are available in six standard sizes and in capacities of 2,000 to 4,000 lb. Weighing from 14 to 42 lb., they load/unload quick, efficient and positioning easily results in fast material flow in freight car loading or unloading operations.

Model Inc., 1906 Meier St., Farmington, Mich.

Circle 14 on Reader Service



Penetrating the "thermal thicket"

Flying at two to three times the speed of sound, airplanes and missiles enter the "thermal thicket," where heat is so intense that rubber and plastic will no longer hold their shape, lubricants boil away, and electronics grow weak or better.

New materials and designs, and new testing techniques, are being developed to cope with these and other problems of supersonic flight. If test equipment does not exist, Boeing engineers create their own—as they have in the test device shown above. It simulates the temperatures of the actual "thick" sections 700 degrees or more in a few seconds, to

simulate the sudden temperature rise that a fast-climbing missile encounters.

Such tests carry Boeing engineers another step forward through the "thermal thicket." But with each step, new and greater obstacles appear.

Many of Boeing's 6,000 engineers are now meeting these challenges. They are developing an air conditioning system, adequate for a small hotel, to keep men and equipment cool in the soaring temperatures of supersonic flight. They are working with manufacturers in other industries to produce new heat-resistant materials... better insulation...

electrical systems that won't break down under heat...new tools and ways of cooling them where conventional ones would blow out, then melt, then burn.

As a contribution toward aviation progress, Boeing provides Lebanon facilities for research and development probably not equaled by those of any private concern in the world. But even more important are the men themselves. Their skill, imagination and devoted research will bring you even more powerful weapons of defense, and faster, safer, more comfortable transportation in the epoch of supersonic flight just ahead.

BOEING

New Missile Products

Auxiliary Power Unit

Auxiliary power unit provides electrical and mechanical as well as hydraulic power to operate guidance and control systems in guided missiles. The unit weighs 29 lb. and has dimensions of 13x16x7 in.

It develops power of 674 w and can be up-rated to 1,600 w, which, according to the manufacturer, is enough to supply the power needs of three ordnance loads.

The power unit performs with either a liquid or solid propellant, either of which burns to produce gas directed against a turbine wheel, mounted on the same shaft as an induction generator rotating at about 24,000 rpm. An oil jet shaft turned by a piston gear system can operate electric controls and characterize as turn a pump for hydraulic power up to 5.5 hp.

A/R Research Manufacturing Div., GenCorp, Los Angeles 45, Calif.



Guided Missile Accelerometer

New accelerometer for airborne flight control and fire control is rated for operation in maximum high speed maneuvers where acceleration measurement is required for precise guidance and control. It is adapted from the GLH guided missile accelerometers, Model GLO.

The instrument is available in ranges from plus or minus 0.1 to 5G or up to plus or minus 50G with inherent damping. It has an AN plug type connector. Assembly type case is filled with oil to damp vibrations of the parts, enabling the instrument to operate to specifications in the most severe vibrational environment. Standard Model GLO has one piezoelectric; however, dual piezoelectric and output can be provided.

GenCorp, Inc., 2201 Federal Ave., Los Angeles 64, Calif.

CERAMICAST

Typical of the infinite shapes and sizes that can be cast with CERAMICAST process is this casting, which is a jet aircraft turbine.

Lebanon's new casting process for...

CLOSE TOLERANCE STEEL CASTINGS AT LOW COST

- FOR QUALITY**
 - ✓ **TOLERANCES** as close as $\pm .002$ to $\pm .005$ per inch.
 - ✓ **INTRICATE SHAPES** Ideal for castings of complex design.
 - ✓ **THIN SECTIONS:** Metal cast as thin as 1/32 of an inch. Thin-like refers to E20 or less.
 - ✓ **SMOOTH SURFACES:** Variations held to .125 micro-inches or better.
- FOR PRICE**
 - ✓ **LOWER PRODUCTION COSTS:** Jobbing work or metal patterns may be used. Design changes quick and inexpensive.
 - ✓ **REDUCED MACHINING COSTS:** Smooth, accurate castings greatly reduce or eliminate machining.
 - ✓ **SHORT LEAD TIME.**

ADAPTABLE TO MANY CASTING SIZES AND ALLOYS—casting weights up to one hundred pounds or more. Carbon steel, stainless steel, alloy steels, titanium alloys and the superalloys.

SEND US YOUR BLUEPRINTS Our sales engineering department will show you how the revolutionary Lebanon CERAMICAST Process can be adapted to your present design.

*Specialized heat treating operations with Heat Treating, Inc., Lehigh, England



LEBANON STEEL FOUNDRY
45 LEBANON STREET LEBANON, PENNSYLVANIA
CARBON, LOW ALLOY AND STAINLESS STEEL CASTINGS

Engineers

OPPORTUNITIES with established flight research organization engaged in all phases of flight test work.

Systems Installation

Diagnostic and hydraulic systems and associated direct component installation in airplanes.

Aircraft Structures

Airframe structural layout and stress analysis.

Instrumentation

Development and flight test of all forms of aeromedical instrumentation.

Flight Test

Engineers with experience in flight testing of airplanes and its flight control equipment.

SUBMIT RESUME
Att: Robert Stewart

Phone for Appointment
RONKONKOMA, 9-8286
(RONKONKOMA, N. Y.)

SPERRY

GYROSCOPE COMPANY

Division of Sperry Rand Corp.
P.O. BOX 218
RONKONKOMA, L.I., N.Y.

ALSO ON THE MARKET

Aircraft fuel gage tests, USAF Type MD-1, is a direct-reading variable capacitor with a range of 0 to 6200 ohm. The moisture-proof device is shock-mounted within a portable aluminum alloy carrying case and is suitable for field use, as a bench meter or portable tester. Accuracy is 0.1%, capacitance values in increments of 0.1 mil are obtained.—Tektro Industries Corp., 95-18 57th St., Long Island City 1, N. Y.

Linear actuator for air or hydraulic, weighs 2 lb. and conforms to MIL-A-8664 specs. Actuator is rated at 650 lb. maximum operating load and 2,600 lb. allowable static load.—Aerobase Aero-Comp Corp., 1454 Chestnut Ave., STL 3, St. L.

Gold methyl methacrylate lenses, are outstanding for impact wear, are available in safety spectacle forms. The gold lenses adhere easily to plastic and retain by softening glass and absorbing almost 100% of frontal ultra-violet rays, most heat channels.—Wellsco Optical Co., 212 West Exchange St., Providence 3, R. I.



FORMABLE CORE MATERIAL sets only into compressed fiber mold, setting by exposure by an activated 95% air bonded aluminum silicate glass pad built for Com-Con Inc. Design. Measuring 28 in. long and up to 5 ft. in diameter, the pad is laminated in sections using "adhesive" aluminum foil core, which permits the formation of extreme compound curvatures without welding, tapping or the need for permanent or strong. Sandwich construction is employed to obtain lightweight, combined sections with a minimum of production and tooling expense.

Manufacturers in Nassau Industries, 1832 Moore St., San Diego 1, Calif.

Tough plastic covers for deaeration models have been developed to increase the life and durability of deaerators. The pigments make possible a permanent transfer in quantity.—Allen Tech, Inc., 8360 Beech Ave., Cleveland 3, Ohio.

New hydraulic Kevlar can handle a maximum payload of 3,160 lb. lifting 4 tons at a maximum height of 324 in., to a maximum of 124 in. Overhead operation is made possible by means of a remote control lifting and lowering mechanism.—Kevlar Engineering Co., 1444 S. San Pedro St., Los Angeles, Calif.

Portable pressure instrument for measuring torque and combustibles in exhaust gases is built into an aluminum carrying case. Model 1211 is 10 in. and weighs 95 lb. Oxygen and combustibles are measured on separate scales.—Instrument Div., Davis Emergency Equipment Co., 55 Haled St., Newark, N. J.

Concealed box for shipping airplane propellers affords protection to precast blades, reduces package cost and provides convenience in packing and unpacking. The container consists of five principal parts, three boxes (one for each blade) and two triangular caps to house the hub and hold the individual boxes in position.—Gorham Containers Corp., 111 N. Fourth St., St. Louis 2, Mo.

Gak O Seal for AN electric plug provides area leakage sealing. It is available with a variety of gaskets and mixtures to seal temperatures from -65 to 350°F (500° Fahrenheit) and both low and high pressures.—Franklin C. Walls Co., Inc., 1644 Eastman Drive, Culver City, Calif.

Densol 5600 sheet material is made of Teflon into which inert fibers have been incorporated by a process that reinforces the fiber structure. These reinforced sheets give the material greater resistance to acid, low heat, abrasion and extrusion than is possessed by unreinforced Teflon. Continuous service up to 500°F is permissible, with intermittent service up to 600°F.—Rogers Corp., Rogers, Conn.

Double acting tube pressing units for press bristles and punch presses are used in fabricating aircraft components where clean, smooth, tapered single or multiple holes are required in tubular parts. The units have a capacity of 4 to 1 in. O.D. tube, maximum punch diameter of 3/16 in., maximum wall thickness of tubing .093 in. Tube pressing units can be set up on the

Cline Electric

**HELPS OLD MOTHER HEN
 GATHER HER CHICKENS**



Small airplane C-47 flying

Then a squadron of planes into the air from a floating carrier base—those the glances around the vast ocean sky at speeds sometimes faster than sound. While her chickens have assembled, put old mother hen herself, through violent tactical maneuvers. After so how or two, bring them all back together again from hundreds of miles apart.

This is routine for the men, planes and ships of the U. S. Navy's "Hatter's Killers"

groups. And Cline Electric, a leading manufacturer of shipboard and aircraft controls, and other electrical apparatus, is playing a vital role in helping make it all possible. We're proud of our assignment!

Private industry, too, can depend on Cline as a supplier of efficient electrical equipment.

CLINE ELECTRIC MANUFACTURING CO.
 2400 West 47th St., Chicago 26, Illinois

Control by

CLINE ELECTRIC

WITH YOUR MINDS BY THE U. S. NAVY

BUILDING PRECISION INTO TARGET ZERO





**Flying
electronic
test-bed
depends on
two Solar gas
turbine APU's**



PLenty of ELECTRICITY for testing advanced electronic gear is needed on the C-121B. These flying laboratories are being equipped with Solar's proven "Marek" gas turbine auxiliary power units, long in use. Two APU's will supply as much as 36 kw d-c, or 48 kw a-c, at 28,000 feet. Can high, compact Marek APU's solve your airborne power needs? Write Solar Aircraft Company, Dept. B-60, San Diego 12, Calif., for more information.



RECORDS, BROCHURES ARE MAINTAINED TO MEET ALLEN REQUEST

ENGINEERS WANTED Unlimited opportunities in Solar's expanding gas turbine program! Write today, giving your experience.



Short cut speed printed-circuit design at Brush Electronics Co.

"3-day job"...done in 3 hours

Brush Electronics Co., a Division of Clevite Corp., Cleveland, Ohio, finds countless uses for photographic materials and techniques in designing more than 700 products.

Take the draftsmen working on that printed-circuit diagram, for example. The original practice was to draw such circuits in ink on heavy Bristol board.

Now, the job is done in a fraction of the time by positioning pencil circles and lines, with adhesive backing, on a form. That is reproduced on Kodagraph Autopositive Film, a positive copy being obtained directly without a negative step. This reproduction—with dense black photographic lines on a translucent base—is sent to the vendor who makes the printed circuits.

Brush has also found that duplicate drawings, made quickly and economically on moonlight-handling Kodagraph Autopositive Paper or Film, are the key to further savings when drawings must be reworked, or vendor prints reproduced. Such duplicates are continuously being

used in place of originals for reference and print making—art protection against possible loss or irretrievability of the originals.

And Brush further streamlines drafting and engineering activities with the help of other Kodak materials—Kodagraph Contact Free-Line Paper for revising and condensing drawings, and making high-quality offset photos...uses Kodak's Film in preparing "pattern" assembly drawings, reduced-size drawings, hardback pages, graphs. *Sometimes four or five materials are used on one job, for top-quality results and savings at every step.*

To learn the ways Kodagraph and other Kodak reproduction materials can serve you, just mail coupon below, or get in touch with your local *Silvermaster*.

Kodagraph Reproduction Materials



MAIL COUPON FOR FREE BOOKLET

EASTMAN KODAK COMPANY
Graphic Reproduction Division, Rochester 4, N. Y.
Gentlemen: Please send me a free copy of your new booklet on Kodagraph Reproduction Materials.

New booklet is
packed with
valuable tips on
saving drafting
time, producing
drawings, saving
better prints.

Name _____ Position _____
Company _____
Street _____
City _____ State _____

Kodak
GRAPHIC



"Brain cells"

SEALED IN GLASS

This Raytheon flat glass subminiature tube is about to be inserted in the pilot mechanism of a missile to help guide it to its target. Long-range radar that "sees" distant planes—precise automatic pilots that "fly" unmanned aircraft—computers that "think" thousands of times a second: these are a few of the sensitive jobs aided by Raytheon tubes, transistors and diodes.

Today, there are more Raytheon subminiature tubes and transistors in use than those of any other manufacturer. Raytheon is also the world's largest manufacturer of magnetrons and klystrons microwave tubes.

Raytheon's record in designing reliable electronic products for home, industry and the armed forces is, in substantial part, due to its pre-eminence in tubes and transistors.

Excellence in Electronics

RAYTHEON

RAYTHEON MANUFACTURING COMPANY
WALTHAM 54, MASSACHUSETTS

plates for mounting to holder and race plates of punch presses—Wako Strip-It Corp., 345 Prince Ave., Newark, New Jersey, N. Y.

Vapour insulation during provides a working temperature range from -45 to 90°C and a dielectric strength of 750 v/mil. The manufacturer reports it exceeds all requirements of specification MIL-I-61118, especially for corrosion, fungus, oil and flame resistance—Foucault Industries, Inc., Santa Barbara, Calif.

Data selection filter cut analyzer when tone frequencies in aircraft and missiles. A type recorder containing the complex wave form is fed into the unit which separates the component frequencies into 24 components which, after amplification and filtering, appear on a scale on the front panel—Hiro Co., Inc., 11475 Vanowen St., N. Hollywood, Calif.

Micro Delta P Controller is a high pressure control system complete in one unit. It serves as pressure sensing element, control pilot and control valve, providing precise water pressure re-



sponse, microsecond control without leakage, constant pressure throughout full flow range—Industrial Engineering Corp., 535 E. Woodlawn, Louisville 6, Ky.

Heavy-duty casters of 8, 10 and 12 in., support as much as 950 lb. for long distances at towing speeds up to 20 mph. The casters conform with military specifications and feature sealed wheel and wheel bearing assembly to keep out dirt, water and foreign matter—Bassett Co., Hartford 2, Conn.

Automatic pressure wet blast unit, for finishing exterior of large metal cylinders, was designed to remove stressors deposits from crude half-spheres approximately 14 in. in diameter—Coo-Fine Co., Inc., 747 Woodlawn St., Hartford, Conn.

INSIDE STORY

Austenal Quality Control



The same technique used in the precision casting of finely wrought austenel and dural applications in non-ferrous metals is put to work for modern industry as Austenal's unique Microcast process. Complex precision parts, such as turbine buckets and nozzles in the wheels pictured above by X-Ray, are cast directly, eliminating costly machining and holding finishing to a minimum.

From the initial mold to the finished casting, Austenal's skilled technicians check for correctness of detail and dimensional accuracy. Then, the completed part is subjected to X-ray and X-Ray examination to search out any internal structural flaws and assure that each part released by Austenal will deliver according to the highest performance standards.

Through sound production, skilled engineering and rapid Quality Control, Austenal serves a growing need in American industry and national defense for fine, high performance precision castings.

See Austenal's original informative films under movie.
"A Story of Industrial Progress." Available without charge.

austenal
LABORATORIES, INC.
microcast division
224 EAST 37th STREET - NEW YORK 16, N. Y.



Programs are being made in the Applied Nuclear Field at CONVAIR — Fort Worth — in nuclear analysis, design and experimentation, including the fields of shielding, radiation effects and nuclear aircraft technology.

As an integral part of General Dynamics Corporation's program of pioneering in Nuclear Fields, CONVAIR'S activities afford training opportunities for engineers and physicists to enter into Nuclear Development at its most advantageous stage.

CONVAIR'S Nuclear Program offers highly rewarding career opportunities both by way of professional accomplishment and personal income. A company-sponsored, in-plant program enables candidates to earn graduate degrees in Nuclear Engineering.



Fort Worth is the South's leading hub of an abundance of sunshine and dry, fresh air conditions for winter living and recreation. Within a few minutes drive of Fort Worth are even more lakes which provide ample facilities for fishing and other water sports.

For further details write Mr. L. TAYLOR
CONVAIR Engineering Personnel Dept. ER
Fort Worth, Texas



CONVAIR
A DIVISION OF GENERAL DYNAMICS CORPORATION
FORT WORTH, TEXAS

SAFETY

over, at the time of the crash the upper portion of the wing was obscured by blood. Just followed suspect, which is believed to have been while the aircraft was in a left climbing turn. Wednesday was widely spread over the extremely rugged mountain in the general direction of about 113 degrees magnetic. One wing which was not examined, it was impact-damaged at 0713. One aircraft was recovered, its wing was twisted for the time and place as usual.

Hazardous Investigation

Initial investigation of the scene was greatly handicapped and confined to deep snow and movement within and deeper snow, water, leading up the steep, rocky, snow-covered slopes. Careful planning went into the organization of aerial expedition, which was scheduled at a later date when the deep snow and ice had gone. This included the use of pack horses and some snowshoeing.

This expedition of investigation reached the site on May 1 and made an exhaustive search of the wreckage after considerable difficulty and hazard, including a rock slide that several several men, one seriously. The results of these findings and later study of some of the recovered components of the aircraft, showed no evidence of fire or structural failure prior to impact, nor of malfunctioning of other engine or other propeller.

A study of recovered radio components disclosed that No. 1 VOR Navigation Receiver was tuned to the frequency of the Minneapolis-Ontonagon Station, No. 2 VOR Navigation Receiver was tuned to the frequency of the Minneapolis 115. Localized radio pilots was using radio both at the time of the crash and had been in their proper respective radio at that time.

Terrain Warning Indicator

The airplane was equipped with a Hughes Terrain Warning Indicator, which automatically flashes a light and sounds an alarm when the aircraft is 500 feet, 1,000 feet, or 1,800 feet from any obstruction, in all. The obstruction may be any where downward from within about 5 degrees of the horizon to all directions—down, across or to either side. It also reads a cover a type of almost a complete hemisphere below the airplane. On the last morning flight of the aircraft the Terrain Warning Indicator had been functioning and it was one of the three checked, and found to be working properly, during the preflight inspection just before the final takeoff.

The aircraft crashed several in Minneapolis at approximately 1219 on February 20, the morning of the last flight. The report of that flight, which was TWA No. 380, reported the following items which were entered in the aircraft log.

4. Propeller reversing on takeoff.
5. Right-hand propeller had in consequence indicated 15 psi.

6. Wind shield. Reported replacement of desert fuel. Fuel in dehydrating N 8016 on flight

"Sentinels of Security"

In strategic locations across the free world our sentinels of security wear the skies — stand ready day and night to protect our frontiers and citizens. Your confidence is assured in electronic devices engineered by Stewart-Warner Electric imagination and produced with Stewart-Warner Electric precision.

**STEWART
WARNER
ELECTRIC**



- Radar Systems
- Traffic Controls
- Communications
- Navigational Aids
- Countermeasures

SW

Over 10 years of experience in electronic
RESEARCH • DEVELOPMENT • PRODUCTION
Address Inquiries to:

STEWART-WARNER ELECTRIC • Government Contract Department
Division of Stewart-Warner Corp. • 1200 North LaSalle Ave. • Chicago 10, Illinois

an
ENGINEER'S
view...



MCDONNELL

ENGINEERS who have selected McDonnell, to start, or continue their engineering career, have been placed with their first look at our large integrated plant in St. Louis. Modern facilities and up-to-the-minute engineering equipment are but a few of the many advantages of joining our organization.

The McDonnell Engineering team continues to grow. New development contracts for airplanes and missiles allow us to enter stimulating careers in the fields of Weapons Systems Analysis, Preliminary and Advanced Design, Stress Analysis, Aerodynamics, Thermodynamics, Dynamics, Radar Test Engineering, Missile Flight Test (Department Head needed), Missile Aerelasticity and Flutter (Department Head needed).

Write in confidence to:
TECHNICAL PLACEMENT SUPERVISOR
BOX 314—ST. LOUIS 2, MISSOURI



HOW TO CALM EMERGENCIES!



USAF HERCULES



The early presence of U.S. troops is a crucial factor in the success of our operations and general tactical success. The important thing is getting them there as fast as possible.

The new C-130 Hercules is an excellent airplane for this job. This combat troop transport carries 32 fully equipped troops at high speed over long ranges in any weather conditions, good or bad, which increases its tactical value.

The Hercules was designed for rugged service. Its unique rotors allow it to land on rough terrain, take off from short runways, and land on water. It's a real workhorse.

The Hercules is a versatile transport for the USAF as a general purpose transport, cargo carrier, troop carrier and rescue ambulance. It's a major product of Government Aircraft Plant No. 1, Marietta, Georgia, America's first helicopter production line for transport.

LOCKHEED

AIRCRAFT CORPORATION

Georgia Division Marietta, Georgia





Best way to get
authoritative answers
on your flexible shaft
problems



Call in an S.S. White engineer while working out any problem involving flexible shafts. His line of fit fingerings the accumulated knowledge of over a half a century of specialists in the design, manufacture and application of flexible shafting in all types of remote control and power drive systems.



For instance, if you're working on a new design, let'll be able to save you valuable time in selecting the proper shaft, and can often make recommendations which will help cut costs and improve performance.

Even when it's a case of replacing shafts in an existing application, his help will prove invaluable in suggesting the correct shaft for the job, especially if you've been having difficulty with the old one.

One of all, this advisory service costs nothing and entails no obligation. Its only price is to waste your getting the best in flexible shafting.

**Flexible shaft
information
for you...**



Bulletin 1706 has been information and data on selection and application. Send for a copy. Address Dept. V.
S.S. WHITE INDUSTRIAL DIVISION
30 East 43rd Street, New York 18, N. Y.

S.S. White

**FIRST NAME
IN FLEXIBLE SHAFTS**

S.S. White
FIRST NAME IN
Flexible
Shafts

SAFETY

250, these crews were taken care of and repaid all by the TWA maintenance personnel at Albuquerque, a Boston Service inspection was conducted which indicated the aircraft wasworthy.

At 8:16, eleven minutes after the departure of TWA Flight 250, Panair Azores Flight 61, a Vickers 2-17, took off from Albuquerque for Santa Fe, New Mexico, using the same runway (No. 11). This flight had the same 1970 elevator at 10,500 feet which it followed. Three passengers watched the flight proceed on the back corner of the 15A and still had it in sight when it reappeared over the Wake Lake instrument at 9,500 feet and. Its case revealed that they maintained only approximately one minute of instrument flight over the intersection of the back corner of the 15A location and the 240 degree radial of the Santa Fe Class Range. (The Aeronautics, formerly called Ames.)

In reference to the opening of the Alameda Laboratory to the Wake Lake sector, the change was made and published in effect on the November 30, 1974, issue of the Aeronautics Guide. This change in time was made to avoid any possible confusion with the Alameda Lake Frequency Hertz, only three miles away.

Captain Spring had been originally qualified to fly the Albuquerque-Santa Fe route in 1941 and had been made checked out on February 13, 1955. He had flown this route eleven times previously during February 1955. That Captain Gorman was flying it for the first time that month although he had been once at Wake during the previous month.

ANALYSIS

The flight took off at 0706 and the only indication of the actual crash site in the Wake Forest impact-crashed at 0715. It is assumed that this tells the duration of the flight is eight minutes. It is evident that the aircraft was flown straight from the airport to very near the crash site for there was not time to do much more than traverse the intervening 13 miles. The last scene of ground observation indicates the straight course.

The magnetic course from Albuquerque to the crash site (and to Santa Fe) is about 50 degrees and the magnetic was given as a warning indicating a deviation of flight at the moment of report of about 112 degrees magnetic while at a left climbing turn. This means that the aircraft was turned to its left about 70 degrees from its original heading and climbed just before the crash, as it is made an observation.

Evasive Maneuver Suggested

The pilot must have suddenly realized that he was positioned at the periphery of the mountain and acted quickly. He can only conjecture as to whether the situation was spontaneous with the captain, or the first officer, or indeed both, coming from the Douglas Terrain Warning Indicator of an obstruction ahead, below, or both. The solution of the mountain ahead may, of course, have been brought about by something other than the Terrain Warning Indicator, possibly a glimpse of



experience

**plays a vital role
in every success**

Man's efforts to increase life expectancy comprise one of the noblest of all human endeavors. In this field it is significant that several men compare experiences when major surgery is indicated.

Since Melatron products are used by every major aircraft manufacturing, much has been gained from these experiences. Reports of their experiences have enabled us to build pressure actuated switches that are not only reliable, but exceed the requirements in the specifications.



Pressure-actuated switches for every requirement from zero absolute to 10,000 psi. Melatron switches are used by every major manufacturer of aircraft in the United States.

MELATRON CORPORATION

1000 WASHINGTON ST., BOSTON, MASS. 02111
1000 WASHINGTON ST., BOSTON, MASS. 02111
1000 WASHINGTON ST., BOSTON, MASS. 02111
1000 WASHINGTON ST., BOSTON, MASS. 02111
1000 WASHINGTON ST., BOSTON, MASS. 02111
1000 WASHINGTON ST., BOSTON, MASS. 02111
1000 WASHINGTON ST., BOSTON, MASS. 02111
1000 WASHINGTON ST., BOSTON, MASS. 02111
1000 WASHINGTON ST., BOSTON, MASS. 02111
1000 WASHINGTON ST., BOSTON, MASS. 02111

1000 WASHINGTON ST., BOSTON, MASS. 02111
1000 WASHINGTON ST., BOSTON, MASS. 02111
1000 WASHINGTON ST., BOSTON, MASS. 02111
1000 WASHINGTON ST., BOSTON, MASS. 02111
1000 WASHINGTON ST., BOSTON, MASS. 02111
1000 WASHINGTON ST., BOSTON, MASS. 02111
1000 WASHINGTON ST., BOSTON, MASS. 02111
1000 WASHINGTON ST., BOSTON, MASS. 02111
1000 WASHINGTON ST., BOSTON, MASS. 02111
1000 WASHINGTON ST., BOSTON, MASS. 02111



The Boeing B-47 with six jet engines, each supplying 6,000 pounds thrust, put it in the "100 mile per hour speed class." Operating range is more than 3,000 miles.

Cold drawn Shelby Seamless Tubes provide *high strength, low weight* outrigger struts for B-47 Stratojet



The landing gear of the 100-ton B-47 Stratojet consists of dual main wheels in tandem with single outrigger wheels. The latter are attached to the main wheels by Shelby Seamless Tubes. The outer cylinder of each of the outrigger struts is fabricated from cold drawn USS Shelby Mechanical Tubing.

Shelby Seamless is extremely strong and shock resistant in proportion to its weight. Thus, it is ideal for incorporation into landing gear, engine mounts, intercom, wing spars, fuselage struts, and tail assemblies. Moreover, with Shelby Seamless Tubing, the basic shape for myriad aircraft parts is already made—and each section of tubing is as round as the solid steel forming from which it is pierced. Thoroughly uniform and dimensionally accurate, Shelby Seamless Tubing is sure to bend, shape, machine and weld.

NATIONAL TUBE DIVISION, UNITED STATES STEEL CORPORATION, PITTSBURGH, PA.
(Tubing Division)

CHICAGO—CHENEA STEEL DIVISION, 530 FARMERS MARKET (First Information)
DETROIT—CHENEA STEEL DIVISION, 10000 CANTON, NEW YORK



SHELBY SEAMLESS MECHANICAL TUBING

UNITED STATES STEEL

Shelby Seamless is produced to existing aircraft standards in a wide range of diameters, wall thicknesses and rigid tolerances. For further information or for help in specifying Shelby Seamless Mechanical Tubing to your design specifications, write to National Tube Division, United States Steel, 635 William Penn Place, Pittsburgh 30, Pennsylvania.

"WALLS WITHOUT WEBS"

The odd story of the marriage between Shelby Seamless Pipe and Tubes is a valuable line of design for thinking in industrial groups, clubs, school groups and the educational world. It is a line of design in industrial and educational groups of the most direct and well known in the world.



• SAFETY

times close below, or ahead, or both. Obviously an instant disaster was averted. The flight, as an attempt to determine a cause for the pilot's return in passing the cone there, ended all possible, evidence and investigation. Conclusion was given to a possible misunderstanding in the ATC clearance.

It is interesting to note that the E15 degree radial of the Santa Fe Ocean Range, which is 156 degrees from that range, is very nearly in line with the Albuquerque Airport and the crash site. This is not allowed to be a highly accurate means of navigation error potentially concealing the exactness of the weather meeting along the reference route.

As previously stated, the first officer was extremely unskilled with the Albuquerque area. In identifying the location of the Weather Information the E15-degree radial of the Albuquerque Ocean was mentioned. Had this cone been drawn with the 30-degree radial of the Santa Fe Ocean radial of the Albuquerque Ocean, the aircraft would conceivably have arrived close to the point of impact.

It is impossible to know what changes may have been made in the radio frequency prior to the accident. This thought is offered with the full realization that it is merely speculative and completely unproven. The accident's severity was based on the proper frequency for using the Albuquerque, Los Angeles and Santa Fe range in accordance with the flight clearance. However, the flight did not follow the plan.

Could Have Topped Ridge

It is difficult to ascertain of the crew attempting to climb a 10,000 foot ridge at 5,000 feet, especially when the aircraft was capable of climbing to an altitude which would mean that the ridge. The Maize 404 (gross weight) was not shown in the weather information, only at 5,100 feet per minute up to 5,000 feet and slightly less than that thereafter. The rate of climb would have brought the aircraft about 100 feet above the ridge during the climb. With such low power the ridge could have been easily topped. There seems to be an amazing explanation of why the aircraft was not crashed, perhaps the pilot flew the aircraft very carefully.

The cause of the crash was not known and was neither authorized by the Civil Aeronautics Administration nor mentioned by the FAA. The cause and only possible cause is in the Santa Fe range, which is 156 degrees from the west to several miles. The aircraft distance between the airport and Santa Fe is 15 miles. The distance is 45 miles. This difference of 105 miles would amount to an about 100 miles difference in time. However the flight departed Albuquerque on schedule and if a had been drawn according to the flight plan would have arrived at Santa Fe on time.

Wind velocity over the Santa Fe Mountain was indicated to be too light to produce an equivalent "mountain effect" such as severe turbulence, downdrafts and crosswinds which could cause a crash. Furthermore such effects when present are usually seen by the crew and the pilot, whereas this accident oc-



You have it. But it was not enough to go around.

Not so long ago, an engineer strapped on a degree. Yet afterwards you down a track. You just could not find a job. You would not you obtain your hard-earned knowledge, much less start to build a career.

Times change, though. The pattern of events, forecast around World War II, showed a shift in the balance. The demand for engineers began to exceed the supply... so much so that today there are not enough of you to go around.

We need engineers and skilled technicians. That handful of other engineers do, too, is extremely well educated, nearly by thinking through the pages of my degree journal. Why should you choose to above them? Perhaps you should not. Neither should you come to that decision without first becoming fully aware of our record... who we are, what we do, where our future lies. We would like to tell you about our company. We hope, too, that you will recognize and give us the opportunity to evaluate you. You can do this by writing to Mr. Richard Aiken, Engineering Personnel.



ONE OF THE 15,000 OF

YOUR AIRCRAFT REGISTRATION

SIKORSKY AIRCRAFT

BRIDGEPORT 1, CONNECTICUT

1

Dear wife and kids:

Not here OK today. Couldn't wait to tell you what I think of Farnsworth and Fort Wayne. It's more than a place to work... it's a way of life! Most of the folks here own their own homes. There are no row houses and that cottage in the country is real and only 10 minutes from everywhere.

Schools? There are 50 of them (full time... no half day shifts) 15 beautiful High schools and I can take grad work at Purdue here at Farnsworth's expense!

This is also a town of churches... 132 in a town of 135,000 that boasts one of the lowest juvenile delinquency rates in the country.

There's also a full size, full season symphony orchestra... World championship basketball and hockey in a new 3 million dollar coliseum, that's out of this world. (Are you listening, Jackie?)

Tell Joe and his wife to start packing because there's plenty of room here for more engineers like him in R and D and systems engineering in missiles, radar, antennas, microwaves, test equipment, countermeasures, transmitter applications and other phases. Tell him to write the Technical Employment Manager, Farnsworth Electronics Co. (a division of IT & T) at Fort Wayne, Ind. He'll be glad he did.

I can't wait until you and the kids get here... I know you'll love it. And, like they say at Farnsworth, "Very, very few ever leave it."

Love Jack

ELECTRONIC ENG.
MECHANICAL ENG.
LARGE Company...
Stability &
Security
SMALL Division...
Recognition &
Responsibility
Bendix **York offers both!**

As a member, depending Division of Bendix Aviation Corporation, Bendix York is a challenging personal growth opportunity... It's your chance to get specific experience on the spot in the area of electronics and aerospace development and design. And, utilizing all systems facilities, (and utilizing) being confident Operating the Electronic Division and Junior Aerospace Engineers, Mechanical Engineers, designers and draftsmen.

Address: Dept. A
Bendix
AVIATION CORPORATION
York
DIVISION
York, Penna. York 2222

Engineer
**AIRCRAFT PROJECT
WEIGHT CONTROL
ENGINEER**

To ensure responsibility for the weight and balance control of a major aircraft project.

Must be qualified to give proper technical guidance in design groups on related structural concepts and design elements including weight of aircraft and is superior interpretation of all necessary weight and balance reports.

Applicants should have the equivalent of a degree in Engineering and 3 to 7 years' directly related weight control experience. Confidence, personal interviews may be arranged by company.

Engineer Personnel
**CHANCE VOUGHT
AIRCRAFT**
A Division of
P. O. Box 1607 Dallas, Texas

**OUTSTANDING
ENGINEERING
OPPORTUNITY**

Are you a specialist as a recent graduate graduate or interested in one or more of the following fields?

- Aero-Thermodynamics
- Internal Aerodynamics
- External Aerodynamics
- Ballistics
- Ram Jet and Turbo Jet Test and Performance
- Transonic and Supersonic Design and Test Operations
- Turbine and Compressor Design

Sverdrup & Parcel, Inc. is engaged both internally and externally in design and consultation of advanced and unusual associated test facilities which require the theory and application of these special fields. The wide variety of our work, embracing the design and review of industrial development facilities, offers challenging problems and provides excellent opportunity for individual development and advancement.

Exciting salary and extent of responsibility are dependent upon individual ability and experience. Fringe benefits include an unusually attractive Employee Benefit Plan which furnishes income (income and provides for retirement, paid vacations, holidays and sick leave, overtime rates, and an employees' club which offers interesting social and practical values. Two excellent universities offer opportunity for advanced education.

Your letter of inquiry will receive prompt attention and reply. Please write to—

SVERDRUP & PARCEL, Inc.
Consulting Engineers
915 Olive St. Suite 1, Inc.



aerial attack

Q: What has this to do with the aircraft industry—and you?

A: It may have plenty to do with both. Here's how:

Football teams are judged by scoring ability to top competition—teamwork, form, ability, strategy, class. So, too, are aircraft companies.

Martin has evolved one of the finest engineering teams in the whole world of aviation. And under the new Martin concept of design and development by team operation, every engineering problem—from today's experimental contract to the frontier problems of the future—is the target for a coordinated "aerial attack" by a top-flight team of specialists.

Result: Martin's team operation technique has opened up important opportunities for young creative engineers.

Contact: J. M. Holliday, Dept. A-11, The Martin Company, Baltimore 5, Maryland.

MARTIN
BALTIMORE

Thiokol Chemical Corporation

HAS IMMEDIATE CAREER OPPORTUNITIES



FOR

- Chemical Engineers
- Mechanical Engineers
- Aeronautical Engineers
- Chemists
- Statisticians

• THIOKOL CHEMICAL CORPORATION'S well integrated programs in advanced Rocket Motor Design and Development, Propellant Research, Process Techniques, Formulation Evaluation, Manufacturing Problems, and related work have established its leadership in the increasingly important field of Solid Propellant Rocketry and Propulsion Systems.

Stable employment, professional growth and advancement, with full company benefits are offered at three locations—northern Alabama, eastern Texas, and northern Maryland.

Your resume of training and experience or letter of inquiry will be given prompt and welcome attention. Previous experience in the rocket propulsion field is not essential.

Write to: Personnel Department
THIOKOL CHEMICAL CORPORATION
RESEARCH DIVISION
BENTONVILLE, ALABAMA

Bendix

IN SOUTHERN CALIFORNIA

HAS 3 EXCELLENT POSITIONS OPEN FOR
SONAR DESIGN ENGINEERS

Pacific Division is engaged in the development of sonar equipment for the United States Navy. This project represents an exceptional opportunity for some design engineers with a minimum of 2 to 4 years professional experience. Please write to: W. C. Nelson, Engineering Employment Manager.

Bendix
PACIFIC DIVISION
"Bendix" Division Corporation
10000 HOLLYWOOD BLVD.

CALTECH

SOUTHERN CALIFORNIA
COOPERATIVE WIND TUNNEL
Pasadena, CaliforniaAERODYNAMIC DEVELOPMENT AND
TEST PROJECT ENGINEERS

M.S. or equivalent degree in Aeronautical Engineering and experience in aerodynamics in the field of wind tunnel design, development and operation.

AERONAUTICAL ENGINEERS

B.S. or M.S. Experience in general aerodynamic and structural design.

ELECTRICAL DESIGN ENGINEERS

B.S. required. Experience in instrument design or electronic industrial controls.

- Competitive salaries
- Outstanding benefits
- Opportunity for great study
- Relocation expense paid

Send resume to write for
further information to:

Mr. J. H. Swart
CALIFORNIA INSTITUTE
OF TECHNOLOGY
Pasadena, California

ENGINEER

An Interesting Assignment
in an Advanced

Radar Nicolas Program

Look for responsibility for keeping abreast of "the state of the art" in evaluating, analyzing and recommending suitable type radar equipment for current applications in active missile systems testing and testing systems. This is often both a highly interesting and highly responsible assignment. For further information, contact the Radiation Type Dept.

This position with General Electric offers maximum personal and professional advancement. Excellent benefits, salary, and working conditions. Write for information.

Please send resume to:
MR. JAMES DENISON
Special Services Bureau Dept.

GENERAL ELECTRIC

200 Cambridge Avenue
Schenectady, N. Y.

ENGINEERS

NORTH AMERICAN'S MISSILE

Dept. offers

ENGINEERS,
PHYSICISTS,
DESIGNERS

Charters in design
and development of

Guided Missiles

Position in North America with N.A.A. is a highly responsible position. It offers a wide range of opportunities for growth and advancement. The position is open to all who are interested in the field of guided missiles.

STATIONING ENGINEERS — Analyze and design missile systems and components.

PROPERTY ENGINEERS — Develop and design missile systems and components.

STRUCTURAL ENGINEERS — Develop and design missile systems and components.

DESIGN AND PLANNING ENGINEERS — Develop and design missile systems and components.

PLANNING ENGINEERS — Develop and design missile systems and components.

CONSTRUCTION ENGINEERS — Develop and design missile systems and components.

Supporting Personnel

ENGINEERING MANAGEMENT PERSONNEL
COMPUTER PROGRAMMERS
Administrative Service Staff

CONTACT BOX A-43
Engineering Personnel
Department 9720

12214 LAKEWOOD BLVD.
DOWNEY, CALIFORNIA

**NORTH
AMERICAN
AVIATION**

99.07*
ENGINEERS
and DESIGNERS
Stay with



THE ELECTRONICS DIVISION
OF
GENERAL MOTORS

* Our current monthly turnover figures are phenomenally good. Nine years, we are proud to say, for years. It speaks well for the job opportunities, working conditions and the wages we pay our Engineers and Designers. Develop with your future. Write us today.



Write today for Employment Application
Mr. Louis E. Berk, Supervisor of Employment

AC SPARK PLUG • THE ELECTRONICS DIVISION
GENERAL MOTORS CORPORATION
MILWAUKEE 2, WISCONSIN

PIONEERING
OPPORTUNITIES
in the following fields:

- MISSILE GUIDANCE SYSTEMS
- JET and TURBO PROP ENGINE CONTROLS
- REMOTE NAVIGATIONAL COMPUTER SYSTEMS
- AIRBORNE FIRE CONTROL
- R.F. COMMUNICATIONS
- MICRO-WAVE EQUIPMENT



ENGINEERS

Electronic • Mechanical
DESIGNERS • DRAFTSMEN

How do you Measure success?

Some measure success only by money, others by the enjoyment they get out of their work. But the true measure of success is a combination of both plus the knowledge that your efforts are recognized and appreciated.

Melpar engineers find discovery and opportunity for professional growth; they enjoy being part of a highly creative staff without losing their individuality, and they benefit from Melpar's completely assigned duties for more responsibility than design engineers through production.

To learn how Melpar measures up to your own standards send complete resume to:

Talent Personnel Department

Melpar, Inc.

Subsidiary of Westinghouse Electric Corp.
1810 Ardmore Road, West, APO 970, Falls Church, Va.
15 Galen Street, Watertown, Mass. • 01901 • Tel. 617-921-1100

ENGINEERS

THE OFFICE ENGINEERING LABORATORY
OF THE JAMES HOPKINS UNIVERSITY
offers an exceptional opportunity for
professional advancement in a well-
equipped laboratory in a rapidly
growing environment of high
technical responsibility and self-direction.

Our position of GUIDED MISSILE RESEARCH and DEVELOPMENT

provides such an opportunity
for you in:

- SUPERSONIC MISSILE DESIGN
- WIND TUNNEL TESTS AND
DATA ANALYSIS
- RAMJET DESIGN AND ANALYSIS
- MISSILE SYSTEM DEVELOPMENT
- DESIGN AND LAYOUT OF
MISSILE COMPONENTS
- RESEARCH AND ANALYSIS IN
AERODYNAMIC STABILITY &
CONTROL

Please send resume to:
Professional Staff Department

APPLIED PHYSICS LABORATORY
THE JAMES HOPKINS UNIVERSITY
P.O. Box 36000
Silver Spring, Maryland

NORTHERN IRELAND

offer you great opportunity in the
Aircraft Industry

Permanent staff and head
of SHOOT BROTHERS & HARRISON
LIMITED, if you are a graduate
engineer, technician or draughtsman
with experience in these fields:

- AIRCRAFT
- MECHANICAL
- ELECTRICAL
- ELECTRONIC
- HYDRAULIC
- PERSONNEL ENGINEERING

The facilities are new and conditions
are good. Attractive salaries. Free
medical services and a Pension Fund
are available.

and last is the chance to
thrive in a modern, home-like
aerodrome industry with clear
long-term prospects of great interest.

Applications to:

Staff Department, Office, P. O.
Box 24, Belfast, Northern Ireland,
contact S.A. 110

WANTED

AIRCRAFT RADIO MAN
with Radio, Cable and Wire knowledge
for aircraft maintenance. Must be able to
read and understand aircraft wiring diagrams.
P.O. Box 1000, Airfield Road,
P.O. Box 1000, Airfield Road, P.O. Box 1000

ENGINEERS

PERMANENT
CREATIVE OPPORTUNITIES
FOR

ELECTRICAL
AND
MECHANICAL
ENGINEERS
AT

Bendix

Immediate openings for:

SENIOR COMPUTER ENGINEER

At least five years experience with
analog computers with digital computer
time. A degree in electrical engineering
or math and physics required.
Working in the field of aircraft and
missile systems, particularly including
gun systems, navigation and control systems.
Work will be with high-speed digital
and analog computers and digital
control systems. The last working experience
should be in analog computer and/or
digital systems.

MAGNETIC AMPLIFIER SYSTEMS ENGINEER

Electrical engineer with many years
experience in the development of analog
and digital computer systems and
component design and testing
experience. Other experience and skill
desired.

COMPUTER ENGINEER

Graduate engineer thoroughly qualified
in a digital computer programming
language, including assembly and
proficient knowledge in test system
development, in preparation of data for
computer applications. Set up new
equipment. Work with complex digital
and control problems characteristic of
the jet engine fuel system and landing
gear fields.

LIQUID PROPELLANT ROCKET CONTROL ENGINEER

Mathematical or electrical engineer to
supervise the research and development
of liquid propellant rocket control
systems, design, component design,
development and testing.

The salary of these positions will be
determined by prior ability and experience.

Send detailed resume listing where
you, including salary, experience, and
education.

TECHNICAL EMPLOYMENT DEPARTMENT
BENDIX PRODUCTS DIVISION OF
BENDIX AVIATION CORPORATION

101 West Bank Drive

South Bend, Indiana

We guarantee you an immediate reply.

HURRICANES HARNESSED...



...for flight progress

Huge compressors... Valves, THREE... TEN times the speed of sound... World's largest electric motors... Unique test sections for development of PROPULSION SYSTEMS, AIRCRAFT, GUIDED MISSILES... A variety of interesting tasks for engineers of ARQ, INCORPORATED, operating contractor for the Air Force's ARNOLD ENGINEERING DEVELOPMENT CENTER.

Peer your professional growth with the stabilized future... the progress of AERONAUTICAL RESEARCH AND DEVELOPMENT... AERONAUTICAL, ELECTRICAL, MECHANICAL engineers, TECHNICAL SPECIALISTS... investigate the current staff opportunities with ARQ, INCORPORATED... Enjoy your work... and enjoy your living in clean, comfortable TENNESSEE...

Write Lee Kelley, Box 162

ARQ, INC.
BIRMINGHAM, TENNESSEE

CHIEF OF MANUFACTURING METHODS AND RESEARCH

Well-established, prime aircraft manufacturer has openings for a Chief of Manufacturing Methods and Research and a Supervisor, Manufacturing Research in its Manufacturing Engineering Division. The Supervisor, Manufacturing Research will report to the Chief of Manufacturing Methods and Research who will be responsible for providing research data and standard applications regarding tooling, manufacturing methods and machine tool utilization to tool planning, tool design and manufacturing personnel.

Job requirements include broad knowledge of aircraft tooling in the fields of research, design, planning, methods and processes equivalent to four years' technical college plus ten years' experience. Both positions include base salary in five-figure bracket.

Applicants must be American citizens and willing to relocate within U.S.A. Experience, confidential personal interviews will be arranged with qualified applicants submitting resume to:

Personnel Director
141 St. Stephens Ave. Chicago 10, Ill.

Presenting FOR SALE
The "Tropicana"
Executive DC-3

Ready for immediate delivery



A new, dynamic concept in executive aircraft design... the real forward look, aerodynamic system outlined structure by Douglas Style, new seats, armrests, armrests, 360 degree seats... and yet within the classic warmth of a well-regarded design.

A variable, 6,000 hour service of complete new color and exterior finish. Weight 12,500 lbs. maximum gross weight. Cruising speed over 200 miles per hour. \$45,000.00, price includes self weight.

Also For Sale

Executive DC-3

Just completed through 6,000 hour service of flight 8/10/70-7/24/70. 1970 inspection just before engine on down. Ready for completion to your PERSONAL SPECIFICATIONS.

Executive Learstar

Boeing 737 and 737-400 Learstars. Ready for immediate delivery. Fully equipped Q8 can be modified to your PERSONAL SPECIFICATIONS.

**We Own the Aircraft
We Offer**

Now in stock: Cessna 441, C-425 and Aero Commander



Write, wire or call. Immediate delivery, immediate price presented.
International Airport • Miami 48, Florida • Phone: 64 0411

**FINANCING
and
PURCHASE...LEASEBACK**
Available for Multi-Payer Aircraft
400 E. 14th Avenue, Suite 200
DENVER, CO 80202

**Remmert-Werner
RADAR**
Learstar 350
Learstar 350
Learstar 350

**SALE or LEASE
CESSNA 310**
As described in Remmert-Werner's Delivery
INTERNATIONAL AVIATION CO., INC.
Phone: 64 0411

**FOR SALE
AERO COMMANDER 340**
List Price: \$165,000.00
Our Price: \$159,500.00
GRABRAT AVIATION
471 N. Michigan, Chicago, Illinois 60611

NAVCO
has Collins
1716-1717-518-519-51X-51Z
Communications-Navigation

FOR LEASE
Remmert-Werner, Inc. has two new Aero Commander 340s for lease. One is a 1970 model, the other is a 1971 model. Both are in excellent condition. Write for details.

WANTED
We are looking for a Cessna 441 Conquest II. Write for details.

WANTED
We are looking for a Cessna 441 Conquest II. Write for details.

WANTED
We are looking for a Cessna 441 Conquest II. Write for details.

WANTED
We are looking for a Cessna 441 Conquest II. Write for details.

WANTED
We are looking for a Cessna 441 Conquest II. Write for details.

WANTED
We are looking for a Cessna 441 Conquest II. Write for details.

AIRCRAFT DEALERS

CONSULT LUND FIRST

COMMERCIAL AND MILITARY AIRCRAFT
REPAIR, MAINTENANCE, REMEDIATION
INSTRUMENTS, RADIO, CHART PARTS
We have a large stock of parts and accessories for all makes of aircraft. Write for catalog.

Lund Aviation, Inc.
251 Park Ave. N.E. Minneapolis, MN 55401

**EXECUTIVE & AIRLINE AIRCRAFT
LEASES, SALES & FINANCING**
Also new, used, and leased aircraft. Write for details.

EXECUTIVE TRANSPORT AIRCRAFT
REPAIR, MAINTENANCE, REMEDIATION
INSTRUMENTS, RADIO, CHART PARTS
We have a large stock of parts and accessories for all makes of aircraft. Write for catalog.

OVERHAUL & MAINTENANCE
We have a large stock of parts and accessories for all makes of aircraft. Write for catalog.

Remmert-Werner
1st St. South
Learstar 350
Learstar 350

NAVCO
has Collins
1716-1717-518-519-51X-51Z
Communications-Navigation

WANTED
We are looking for a Cessna 441 Conquest II. Write for details.

WANTED
We are looking for a Cessna 441 Conquest II. Write for details.

WANTED
We are looking for a Cessna 441 Conquest II. Write for details.

WANTED
We are looking for a Cessna 441 Conquest II. Write for details.

WANTED
We are looking for a Cessna 441 Conquest II. Write for details.

Priced to Sell!
RANGER PARTS
ALL UNUSED

Immediate Delivery From Warehouse Stock!

RANGER ENGINE PARTS

EXPLODED VIEW PAGE 12			
PUMP			
100-1000	100-1000	100-1000	100-1000
100-1001	100-1001	100-1001	100-1001
100-1002	100-1002	100-1002	100-1002
100-1003	100-1003	100-1003	100-1003
100-1004	100-1004	100-1004	100-1004
100-1005	100-1005	100-1005	100-1005
100-1006	100-1006	100-1006	100-1006
100-1007	100-1007	100-1007	100-1007
100-1008	100-1008	100-1008	100-1008
100-1009	100-1009	100-1009	100-1009
100-1010	100-1010	100-1010	100-1010
100-1011	100-1011	100-1011	100-1011
100-1012	100-1012	100-1012	100-1012
100-1013	100-1013	100-1013	100-1013
100-1014	100-1014	100-1014	100-1014
100-1015	100-1015	100-1015	100-1015
100-1016	100-1016	100-1016	100-1016
100-1017	100-1017	100-1017	100-1017
100-1018	100-1018	100-1018	100-1018
100-1019	100-1019	100-1019	100-1019
100-1020	100-1020	100-1020	100-1020
100-1021	100-1021	100-1021	100-1021
100-1022	100-1022	100-1022	100-1022
100-1023	100-1023	100-1023	100-1023
100-1024	100-1024	100-1024	100-1024
100-1025	100-1025	100-1025	100-1025
100-1026	100-1026	100-1026	100-1026
100-1027	100-1027	100-1027	100-1027
100-1028	100-1028	100-1028	100-1028
100-1029	100-1029	100-1029	100-1029
100-1030	100-1030	100-1030	100-1030
100-1031	100-1031	100-1031	100-1031
100-1032	100-1032	100-1032	100-1032
100-1033	100-1033	100-1033	100-1033
100-1034	100-1034	100-1034	100-1034
100-1035	100-1035	100-1035	100-1035
100-1036	100-1036	100-1036	100-1036
100-1037	100-1037	100-1037	100-1037
100-1038	100-1038	100-1038	100-1038
100-1039	100-1039	100-1039	100-1039
100-1040	100-1040	100-1040	100-1040
100-1041	100-1041	100-1041	100-1041
100-1042	100-1042	100-1042	100-1042
100-1043	100-1043	100-1043	100-1043
100-1044	100-1044	100-1044	100-1044
100-1045	100-1045	100-1045	100-1045
100-1046	100-1046	100-1046	100-1046
100-1047	100-1047	100-1047	100-1047
100-1048	100-1048	100-1048	100-1048
100-1049	100-1049	100-1049	100-1049
100-1050	100-1050	100-1050	100-1050
100-1051	100-1051	100-1051	100-1051
100-1052	100-1052	100-1052	100-1052
100-1053	100-1053	100-1053	100-1053
100-1054	100-1054	100-1054	100-1054
100-1055	100-1055	100-1055	100-1055
100-1056	100-1056	100-1056	100-1056
100-1057	100-1057	100-1057	100-1057
100-1058	100-1058	100-1058	100-1058
100-1059	100-1059	100-1059	100-1059
100-1060	100-1060	100-1060	100-1060
100-1061	100-1061	100-1061	100-1061
100-1062	100-1062	100-1062	100-1062
100-1063	100-1063	100-1063	100-1063
100-1064	100-1064	100-1064	100-1064
100-1065	100-1065	100-1065	100-1065
100-1066	100-1066	100-1066	100-1066
100-1067	100-1067	100-1067	100-1067
100-1068	100-1068	100-1068	100-1068
100-1069	100-1069	100-1069	100-1069
100-1070	100-1070	100-1070	100-1070
100-1071	100-1071	100-1071	100-1071
100-1072	100-1072	100-1072	100-1072
100-1073	100-1073	100-1073	100-1073
100-1074	100-1074	100-1074	100-1074
100-1075	100-1075	100-1075	100-1075
100-1076	100-1076	100-1076	100-1076
100-1077	100-1077	100-1077	100-1077
100-1078	100-1078	100-1078	100-1078
100-1079	100-1079	100-1079	100-1079
100-1080	100-1080	100-1080	100-1080
100-1081	100-1081	100-1081	100-1081
100-1082	100-1082	100-1082	100-1082
100-1083	100-1083	100-1083	100-1083
100-1084	100-1084	100-1084	100-1084
100-1085	100-1085	100-1085	100-1085
100-1086	100-1086	100-1086	100-1086
100-1087	100-1087	100-1087	100-1087
100-1088	100-1088	100-1088	100-1088
100-1089	100-1089	100-1089	100-1089
100-1090	100-1090	100-1090	100-1090
100-1091	100-1091	100-1091	100-1091
100-1092	100-1092	100-1092	100-1092
100-1093	100-1093	100-1093	100-1093
100-1094	100-1094	100-1094	100-1094
100-1095	100-1095	100-1095	100-1095
100-1096	100-1096	100-1096	100-1096
100-1097	100-1097	100-1097	100-1097
100-1098	100-1098	100-1098	100-1098
100-1099	100-1099	100-1099	100-1099
100-1100	100-1100	100-1100	100-1100
100-1101	100-1101	100-1101	100-1101
100-1102	100-1102	100-1102	100-1102
100-1103	100-1103	100-1103	100-1103
100-1104	100-1104	100-1104	100-1104
100-1105	100-1105	100-1105	100-1105
100-1106	100-1106	100-1106	100-1106
100-1107	100-1107	100-1107	100-1107
100-1108	100-1108	100-1108	100-1108
100-1109	100-1109	100-1109	100-1109
100-1110	100-1110	100-1110	100-1110
100-1111	100-1111	100-1111	100-1111
100-1112	100-1112	100-1112	100-1112
100-1113	100-1113	100-1113	100-1113
100-1114	100-1114	100-1114	100-1114
100-1115	100-1115	100-1115	100-1115
100-1116	100-1116	100-1116	100-1116
100-1117	100-1117	100-1117	100-1117
100-1118	100-1118	100-1118	100-1118
100-1119	100-1119	100-1119	100-1119
100-1120	100-1120	100-1120	100-1120
100-1121	100-1121	100-1121	100-1121
100-1122	100-1122	100-1122	100-1122
100-1123	100-1123	100-1123	100-1123
100-1124	100-1124	100-1124	100-1124
100-1125	100-1125	100-1125	100-1125
100-1126	100-1126	100-1126	100-1126
100-1127	100-1127	100-1127	100-1127
100-1128	100-1128	100-1128	100-1128
100-1129	100-1129	100-1129	100-1129
100-1130	100-1130	100-1130	100-1130
100-1131	100-1131	100-1131	100-1131
100-1132	100-1132	100-1132	100-1132
100-1133	100-1133	100-1133	100-1133
100-1134	100-1134	100-1134	100-1134
100-1135	100-1135	100-1135	100-1135
100-1136	100-1136	100-1136	100-1136
100-1137	100-1137	100-1137	100-1137
100-1138	100-1138	100-1138	100-1138
100-1139	100-1139	100-1139	100-1139
100-1140	100-1140	100-1140	100-1140
100-1141	100-1141	100-1141	100-1141
100-1142	100-1142	100-1142	100-1142
100-1143	100-1143	100-1143	100-1143
100-1144	100-1144	100-1144	100-1144
100-1145	100-1145	100-1145	100-1145
100-1146	100-1146	100-1146	100-1146
100-1147	100-1147	100-1147	100-1147
100-1148	100-1148	100-1148	100-1148
100-1149	100-1149	100-1149	100-1149
100-1150	100-1150	100-1150	100-1150
100-1151	100-1151	100-1151	100-1151
100-1152	100-1152	100-1152	100-1152
100-1153	100-1153	100-1153	100-1153
100-1154	100-1154	100-1154	100-1154
100-1155	100-1155	100-1155	100-1155
100-1156	100-1156	100-1156	100-1156
100-1157	100-1157	100-1157	100-1157
100-1158	100-1158	100-1158	100-1158
100-1159	100-1159	100-1159	100-1159
100-1160	100-1160	100-1160	100-1160
100-1161	100-1161	100-1161	100-1161
100-1162	100-1162	100-1162	100-1162
100-1163	100-1163	100-1163	100-1163
100-1164	100-1164	100-1164	100-1164
100-1165	100-1165	100-1165	100-1165
100-1166	100-1166	100-1166	100-1166
100-1167	100-1167	100-1167	100-1167
100-1168	100-1168	100-1168	100-1168
100-1169	100-1169	100-1169	100-1169
100-1170	100-1170	100-1170	100-1170
100-1171	100-1171	100-1171	100-1171
100-1172	100-1172	100-1172	100-1172
100-1173	100-1173	100-1173	100-1173
100-1174	100-1174	100-1174	100-1174
100-1175	100-1175	100-1175	100-1175
100-1176	100-1176	100-1176	100-1176
100-1177	100-1177	100-1177	100-1177
100-1178	100-1178	100-1178	100-1178
100-1179	100-1179	100-1179	100-1179
100-1180	100-1180	100-1180	100-1180
100-1181	100-1181	100-1181	100-1181
100-1182	100-1182	100-1182	100-1182
100-1183	100-1183	100-1183	100-1183
100-1184	100-1184	100-1184	100-1184
100-1185	100-1185	100-1185	100-1185
100-1186	100-1186	100-1186	100-1186
100-1187	100-1187	100-1187	100-1187
100-1188	100-1188	100-1188	100-1188
100-1189	100-1189	100-1189	100-1189
100-1190	100-1190	100-1190	100-1190
100-1191	100-1191	100-1191	100-1191
100-1192	100-1192	100-1192	100-1192
100-1193	100-1193	100-1193	100-1193
100-1194	100-1194	100-1194	100-1194
100-1195	100-1195	100-1195	100-1195
100-1196	100-1196	100-1196	100-1196
100-1197	100-1197	100-1197	100-1197
100-1198	100-1198	100-1198	100-1198
100-1199	100-1199	100-1199	100-1199
100-1200	100-1200	100-1200	100-1200
100-1201	100-1201	100-1201	100-1201
100-1202	100-1202	100-1202	100-1202
100-1203	100-1203	100-1203	100-1203
100-1204	100-1204	100-1204	100-1204
100-1205	100-1205	100-1205	100-1205
100-1206	100-1206	100-1206	100-1206
100-1207	100-1207	100-1207	100-1207
100-1208	100-1208	100-1208	100-1208
100-1209	100-1209	100-1209	100-1209
100-1210	100-1210	100-1210	100-1210
100-1211	100-1211	100-1211	100-1211
100-1212	100-1212	100-1212	100-1212
100-1213	100-1213	100-1213	100-1213
100-1214	100-1214	100-1214	100-1214
100-1215	100-1215	100-1215	100-1215
100-1216	100-1216	100-1216	100-1216
100-1217	100-1217	100-1217	100-1217
100-1218	100-1218	100-1218	100-1218
100-1219	100-1219	100-1219	100-1219
100-1220	100-1220		

THE WORLD'S LARGEST
PRODUCER OF
READY-TO-INSTALL POWER
PACKAGES FOR AIRPLANES
INVITES YOU TO ENJOY YOUR
WORK AND YOUR LIFE IN

beautiful
SOUTHERN
CALIFORNIA

We believe we can offer you an opportunity to improve your position in the business world—and improve your way of life here at Rohr Aircraft Corporation in beautiful, temperate, exciting Southern California. To strengthen our personnel in various departments, Rohr has a real opportunity for you if you are skilled as an —

ENGINEER
(Aircraft Design or Structural)

LOFTSMAN

JIG & FIXTURE BUILDER
TOOL PLANNER • TOOL DESIGNER

ROHR
AIRCRAFT CORPORATION

Please write giving complete details and we will answer immediately.
Mr. Noel DeWitt, Personnel Department
Rohr Aircraft Corporation
Chula Vista, California

9 miles south of San Diego on busy San Diego Bay

WHO'S WHERE

(Continued from page 9)

Jack W. Sney, director of ground operations for Rapid International Airways.
Charles Mize, commercial relations manager for KLM Royal Dutch Airlines, Grosse Pointe, Michigan.
Barrett E. Conner, New York sales chief of Canadian Pacific Airlines.

Jason J. Kerpner, traffic coordinator for Kable Airlines.

Edward G. Hunt assigned from Conner to become assistant manager of business development of Ralph M. Perton Co., Los Angeles, Calif.

Arthur Sarna, chief research engineer in the Structural Research Department of General Aircraft Laboratories, Inc.

Dr. W. Cleveland Shadley, Jr., assistant consultant at General Electric Company's Electronics Laboratory, Syracuse, N. Y.

Lawrence E. Dandene, manager of Cleveland Aircraft Division of La Roca Div., Westinghouse Electric Corp.

Dr. Donald Albert and Dr. Anne Woods, research director of Westinghouse Research Laboratories.

Edward F. O'Neill, traffic manager of Carr Airlines, Inc.

R. M. Bessett, director of Applications Marketing Department of Radio Corporation of America, P. O. Office, sales manager Military Exchange Service.

Walter K. Thorne, public relations director of Avco Manufacturing Corp's Aircraft Development Division.

James A. MacArthur, Jr., manager of West Coast Sales for Republic Rubber Div., Los Angeles & Tire Corp.

John A. Redgrave, general manager of Yale & Towne Manufacturing Company's Metal's Handling Div., Philadelphia.

Ray L. Walter, general manager of Automatic Transportation Company Div., Chicago.

Raymond B. De Lisle, purchasing agent for Niagara Machine & Tool Works, Buffalo, N. Y.

William M. Hawkins, manager of Los Angeles district sales office at Consolidated Engineering Corp.

Andrew D. Fyfe, manager of sales engineering of Eastern Div. of United Manufacturing Company Division.

Edward F. Salowicki, research metallurgist, Development and Research Div. at International Nickel Co., Inc.

William J. McGowan, director of industrial and commercial relations division of Alle Chemical Manufacturing Co.

Donald R. Wilson, assistant sales manager of Hach Manufacturing Co. Detroit.

B. E. Lusk, industrial regional manager of General Controls Co.

Don F. Carr, assistant to the manager of Tool Steel Sales Div. of Goodrich Steel Company of America.

Corbin R. Brown, San Francisco district manager of Nickel California Battery Corp., Easthampton, Mass.

William A. Smith, new products sales manager of Industrial Products Div. of B. F. Goodrich Co.

George F. Blagden, engineering director of Ship-Tite, Inc.

Donald V. Stabick, research director of Storch-Rohrer, Inc.

Extreme ambient and fluid temperatures as high as 500°F caused by jet combustion products are reduced by Weston's new three-way pilot-operated Balanced High Temperature Valve.

Minimizing fully new design features, it permits the elimination of all moving parts and requires only two static seals.

It is designed to function smoothly at unusually wide temperature ranges, and is suitable for use with many different fluids.

weston

A subsidiary of Borg-Warner Corp.

1851 SHAWAN AVENUE
HOLM HILLS, CALIFORNIA

BW



WHEN THE HEAT'S ON!

AMERICAN AIRLINES



**They're not just tax exemptions
they're travel "deductions"**

**AMERICAN
AIRLINES**
AMERICAN AIRLINES

When you use American's Family $\frac{1}{2}$ Fare Plan, any person purchasing a full fare ticket can take along his or her spouse and their children. A family of four, for instance, can save hundreds of dollars on a coast-to-coast trip. American's Family $\frac{1}{2}$ Fare is in effect from 12:01 noon Mondays to 12:01 noon Thursdays. And you can also use our "Go Now—Pay Later" Plan.



AIR TRANSPORT

Riddle, Aaxico Win Eastern Cargo Routes

5-year certificates awarded in north-south portion of airfreight case, air express operations approved.

Washington-Riddle Airlines and American Air Export and Import Co. have been awarded five-year certificates for north-south cargo service in the eastern United States by the Civil Aeronautics Board in its decision on the north-south portion of the airfreight-ravel case.

The two cargo lines are also authorized to carry air express. They apply to carry air mail and are deferred for consideration in the next part portion of the airfreight-ravel case.

U.S. Airlines' bid to action its airfreight-ravel case.

The CAB awarded these routes to Riddle and Aaxico.

Riddle will operate between Boston, New York, Detroit and Chicago and Miami.

Aaxico will operate between New York, Chicago and Detroit and New Orleans.

Some intermediate points in both certificates are classified as demand service points not requiring regular scheduled service.

Decision Made

The north-south airfreight-ravel case was originally part of the general airfreight-ravel case. When the proceeding became bogged down by the complication of the abandoned merger between Sleek Airlines and Flying Tiger Line, the CAB severed the north-south portion and went ahead with it. The east-west portion is still under consideration.

In the north-south case, Riddle asked for a permanent New York-Florida route and a ten-year Midwest-Florida route. The customer recommended five-year certificates for the current and the Board has decided to follow the recommendation although Vee-Chen from Joseph P. Adams dissented on the issue. He feels Riddle should have a permanent certificate for its New York-Florida route.

The Board and it is convinced that economic amounts of freight will be transported by air and that there is a real increase of cargo potential. But the fact that there are many obstacles still to be handled before cargo carriers can take their proper role in the surface pattern.

The CAB has further experimental periods because south of the service

authorized as new and many of the points involved have seemed little or no cargo service. Shippers will have to be educated and service tested before the certificates can be made permanent, according to the CAB.

Expresses Approved

Both carriers were authorized for the same length of time as the Board can compare the efficiency and effectiveness of two carriers using different techniques and methods.

The Board stressed its emphasis on the recommendation that the air express case be deferred for consideration with the east-west case, although the air mail case was put off for later consideration. The CAB said that a decision on express doesn't amount to a prejudgment of the issue in the east-west case, and that Riddle and Aaxico deserve to have the case decided on the record in the north-south case.

On the merits of the express issue, the CAB said that "no one has advanced any cogent reason why the authority to carry air express should be withheld from these carriers."

The CAB also approved a National Union to sponsor the case on the basis of the fitness of Riddle in connection with outside activities of John Paul Riddle and Paul F. Axtell. The Board concluded that there has been no show of a violation by Riddle in complying with the act or the CAB regulations.

Route Pattern

Riddle's certificate authorizes it to have five air express routes between Boston and Miami via New York, Philadelphia, Baltimore, Washington, Richmond, Jacksonville, Palm Beach, Orlando, Tampa-St. Petersburg, Fort Myers, Sarasota, Fort Lauderdale and West Palm Beach. The Air Mail New York and Philadelphia via demand points.

Nonlocal Division

The CAB noted that times have changed since the 1940 prohibition against cargo carriers doing business with the Russian Espionage Agency and the reasons for the restriction are no longer persuasive.

Observing that participation in Riddle and Aaxico is the air express traffic wouldn't produce any representative amount of revenue, the Board said that any additional revenue will be helpful and the decision effect on the cargo carriers will be negligible.

In selecting certain cities as demand points, the CAB felt that such a des-

cription will help develop cargo traffic at such points and still conform with the experimental nature of the cargo status planned by the Board. The decision favors inclusion of certain marginal points as a means of determining if they should be certified for regular service in the future.

American Airlines and Trans World Airlines objected to the inclusion of service between points in the same area or points on the same route, but the CAB said that the case was very in the scope of the case and decided to allow such service.

National Motion Denied

National Airlines filed a question of fitness with Riddle Airlines in the case and asked that it be removed to secure evidence in the holdings of Arthur Vee-Chen Davis.

National claimed that Davis had holdings in Macair Airlines, Western International and other transportation companies. The Board pointed out that the connection between Davis' holdings and the Civil Aeronautics Act is remote under an exception to another case, and the case doesn't warrant delaying the north-south case.

The CAB also approved a National Union to sponsor the case on the basis of the fitness of Riddle in connection with outside activities of John Paul Riddle and Paul F. Axtell. The Board concluded that there has been no show of a violation by Riddle in complying with the act or the CAB regulations.

Route Pattern

Riddle's certificate authorizes it to have five air express routes between Boston and Miami via New York, Philadelphia, Baltimore, Washington, Richmond, Jacksonville, Palm Beach, Orlando, Tampa-St. Petersburg, Fort Myers, Sarasota, Fort Lauderdale and West Palm Beach. The Air Mail New York and Philadelphia via demand points.

Riddle's certificate authorizes it to have five air express routes between Boston and Miami via New York, Philadelphia, Baltimore, Washington, Richmond, Jacksonville, Palm Beach, Orlando, Tampa-St. Petersburg, Fort Myers, Sarasota, Fort Lauderdale and West Palm Beach. The Air Mail New York and Philadelphia via demand points.

Aaxico's New York-New Orleans

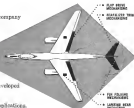
VARD--FIRST IN MECHANICAL ACTUATION

The facilities of the Vard company

are geared to the quality requirements dictated by aircraft standards.

Production

ground ball screws are manufactured with equipment and methods developed by Vard specifically for close tolerance airborne applications.



In handling your specific problem...

Vard engineers will analyze your ball screw requirements to determine the advisability of single or multiple ball screws. Either of these options may utilize all lead balls or alternate lead and spacer balls.

You may be sure that the combination recommended by our analysis will best meet your needs and will be produced by the finest facilities available.

As far possible that one or more of the many types of ball screws are in production at Vard can satisfy your immediate needs.

RESIDENT SALES ENGINEERS
New York City
Dayton, Ohio
Seattle, Washington
Waltham, Kansas

VARD

2181 East Colorado Street
Pacifica, California

route in via Philadelphia, Baltimore, Washington, Richmond, Atlanta, and New Orleans. Philadelphia, Baltimore, Washington and Richmond are demand points.
Aerco's route to the Midwest runs from New Orleans to Indianapolis.

Indianapolis, Louisville, Cincinnati, and Columbus, and beyond Columbus to the terminal point at Chicago and the terminal point at Detroit via Cleveland, Indianapolis, Louisville, Cincinnati and Columbus are demand points.

Irregular Ruling Stirs Diverse Opinions Among Air Carriers

Washington—Strong letter comments of airlines are running at the rate of the Civil Aeronautics Board's historic decision on the Large Inland Case and the Air Exchange Case (AW No. 2) p. 12.

The irregular decision, at once, pleased with their new status in Supplemental Air Carriers and thus, on the decision will give them stability and furnish the public a much needed sphere of air service.

Opinion among the certificated carriers is just as strong as the other three. Generally, they viewed the decision as an answer toward for cost reduction of the low and a dangerous source of new, uncontrolled competition.

Air Exchange Meetings

The Air Transport Association and the Independent Military Air Transport Association, both are preparing final air exchange agreements for CAB approval. ACTA plans to have its plan approved by its members and filed with the Board in mid-December.

IMATA has scheduled meetings of its local directors and members on lines for Dec. 6 and 7 to complete and approve its air exchange plan. A change in the organization's name has also been discussed at the meeting to bring it more into line with IMATA's current function.

Both organizations now operate only trunk traffic exchanges. ACTA has 25 field offices and IMATA has nine. Commercial charter operations will be integrated with military operation when operational, but both associations plan to regional facilities to handle commercial traffic.

ACTA members currently have 99 aircraft available for military charter—28 DC-6s, three DC-6s, 15 C-46s and 17 DC-3s. The IMATA members qualified to operate under the air exchange have one DC-6, 20 DC-6s, 21 C-46s and 11 DC-3s.

The new supplemental carriers feel that the CAB decision gives enough stability and makes it possible for them to conduct a daily regular operation for the first time. They expect that this new stability will make it simpler for them to arrange financing, allowing them to buy new equipment and modernize their fleets.

Reuben D. Potts, Jr., IMATA president, said the service contemplated by CAB is not airline transportation.

Potts says charter transportation is a flexible, special type of travel which is related to the specific needs of the charter and is subject to its schedule. While it may be kept to a minimum, the transportation won't be of the rubber stamp type implied by such terms as "cheap" or "cut-rate," according to Potts.

The supplemental carriers expect the new service authorizations to bring a better balance between civil and military traffic. Presently, about 60 percent of the total traffic is military. If 33 percent, president of ACTA, expects the balance to swing toward civil traffic, while that segment eventually making up about 60% of the total.

The prohibition of a merger between ACTA and IMATA, often discussed in the past by the two associations, may have caused a boost from the CAB decision, although currently, ACTA seems to feel that the best immediate solution would be for the IMATA supplemental carriers to join ACTA, leaving IMATA in possession of scheduled cargo carriers.

'Law of the Jungle'

The certificated airlines are strongly opposed to the 10 flight rules contained in the CAB decision, although they have only minor objections to the charter authorizations. Both trunk carriers and local airlines term the decision "anarchy" and "a law of the jungle."

Speaking in Richmond, Va., at the be of the irregular decision, Stanley Gersitz, executive assistant to the president of the Air Transport Assn., said the airline industry has grown under a doctrine of regulated competition by interdependence.

If the two come when the Civil Aeronautics Board opens the floodgates to unregulated and unregulated competition, you can bet on the present of future military pressure and military aid cutting industries as so-called is marginal rates, and concentration of air transportation where the dollars are more abundant—without regard to the general welfare," Gersitz said.

The certificated airlines point out that steady rule by the CAB in recent years has been all but to guarantee competition and added stability to the industry. The new regulations may well rule the new operations marginal.

Schedule Factor

Objections are also made by the scheduled carriers that the Board ignored past violations of the Civil Aeronautics Act and the Economic Regulations in passing the record of the irregular carrier industry. The national defense aspect of the issue is discussed with the observation that most of the equipment of the irregular is obsolete.

Trunk airlines fear that competition from the supplemental carriers will hurt them in military traffic and will require a change of the regional carriers and local airlines to get off severely.

Local service airlines expect direct impact from supplemental carrier competition for peak period traffic needs, on authorizations and schedules to balance week-day traffic.

Local carriers are also afraid that competition on highly lucrative routes will decrease the trunk airlines from the local airlines to local points over the local airlines to take in their route development.

Hearings Continue On Peninsular Charges

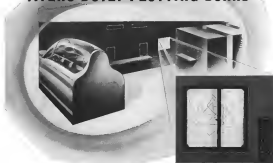
Washington—Peninsular Air Transport, Inc., operator of the chartered DC-4s which crashed at Seattle Nov. 18 with 74 passengers, was charged last summer with violation of an order compelling it (AW No. 22, p. 100). Civil Aeronautics Board orders and preparations caused a continuance of the hearings, which are still in progress.

The charges were made by Civil Aeronautics Administration against Peninsular and Aero Finance Corp., as joint owners irregular airlines. CAA noted its emergency suspension order Aug. 12 against both airlines and asked CAB to consider suspending or revoking the operating rights of each of the Florida base carriers.

CAA initiated a safety enforcement proceeding with the Board by filing complaints alleging 37 counts of safety infractions. The two carriers were charged with violating aircraft, failing to conduct aircraft safety repairs reported inspection time limits, and operating aircraft in excess of pilot flight-time limitations.

The transport suspensions of the two air carriers were lifted by CAA in less than two weeks but CAA has continued to press its case before CAB.

ATLAS BUILT PLOTTING BOARD



Scoreboard For Tomorrow's Pilots

This plotting board designed by McPac Inc.—scoreboard of the new U.S. Air Force electronic calculator for F-100A planes—is another example of Atlas manufacturing ingenuity at work. Atlas specializes in “precision” electro-mechanical assemblies from the pilot steps to production efficiency. From the practical engineering step and the facilities between the idea and the production line.

Bring your electro-mechanical design to us. Our design, production and methods engineers,

tool makers and skilled mechanics are ready to work on your project on a job basis... no man, machine and hours of work it requires and no more. Every machine tool and tool making technique to fit your service to save you time and labor on a complete electro-mechanical assembly or a special part for electronic equipment. Write today for your copy of “Precision Engineering Electro-Mechanical Equipment.” ATLAS PRECISION PRODUCTS CO., Philadelphia 24, Pa. (Div. President Industries).

“From Drawing Board... to Production Line.”



ATLAS
Precision Products

Burwell Urges ‘Third Class’ Fare

Washington—Maintaining that each service does not go far enough in tapping the mass market, Lewis Burwell has called for a new, third class \$100 one-way transatlantic air fare. In a speech to the North Atlantic Transportation Institute of America University, he said:

“We find that a first-class ticket from New York to Paris at \$420 appeals to a theoretical market of about two million people. The tourist fare at \$110 has a wider reach, to about 15 million people. A third-class fare of \$100 would reach 100 million more. This covers just about everybody who has got shoes.”

“These 100 million people represent the market we have sought to be in our bids and the market which the airlines should investigate and exploit.”

Fare to be made on the “third class” fare moving on “low, slow rates,” included

• Both passenger and freight tickets

should be on a par with a hotel room. If the \$100 passenger would up with a suit next to a \$300 passenger, he said, it should be deemed as a bargain hunter also that time found a bargain. Building up previous business, he said, “it is far better to build load factors on light flights, particularly in off-season or on off-days and off hours.”

“Third class” aircraft should be able to carry passengers in one direction and cargo in another.

“Further expansion of an aircraft isn’t the answer because this is still a cost process and the airline must bear the expense of finding and individually landing each passenger and accounting the possibility or probability of being with empty seats. The low service falls that are wanted is much more cost than do not represent the difference between coach and first-class fare.”

To stimulate the purchase of new transport aircraft and increase sales, Burwell urged Defense Department to

promote to avoid the industry a certain amount of business for a period of one to five years.

He said the 1960 high price contracts with the Defense Department have under backlog of \$147 million to \$1.1 billion. He added:

“These orders are scheduled for production and delivery at the end of four years. In many cases specifications are not even final. This is a sound principle, however, because it enables the manufacturer to satisfactorily plan his requirements.”

Burwell called for a life insurance system “highly placed in Civil Aeronautics Administration.” Coordination should be given to “dealing with a lot of fittings and handshakes that cut down gas load and weight, except the risk and the fact that if you are working at 600 mph, you are going through the forest looking whether you are in tag in a 150 mph or a 600 mph class. The airline would price that it was acceptable delivery for the same season people are allowed to stand up on the service,” he said.



Fokker Begins Flight Tests Of New Friendship Airliner

First prototype of the Fokker F-27 Friendship turboprop-powered transport has begun its test program. In photos shown, the plane will look its 12-ft-diameter four-blade propellers. The flight program is being conducted from Schiphol Airport, where the Fokker plant is located. The aircraft is the first of four prototypes to be built. Powered by two Rolls-Royce Dart RB25s to 1,800 hp each plus 575 lb, combined thrust, the Friendship has an economical cruise speed of 275 mph at 20,000 ft, or 1,500 engine rpm. Rate of climb at sea level is 1,100 fpm. Normal stage length with reserves using BRAC method is 100 miles and speed for this distance is said to be 180 mph. Max cruise stage length with fuel reserves at 1,000 ft, ICAO field length takeoff and landing distances are both calculated at 3,840 ft. The Friendship’s pressurized cabin is designed to sustain an altitude equivalent of 6,000 ft at 26,000 ft. Maximum seating is 30 passengers with first-class version planned for 24 seats. The transport’s maximum takeoff weight is 34,200 lb.



New higher Guarantees on



Kaiser Aluminum hand forgings!

As a result of high priority development, Kaiser Aluminum can now supply you with Standard hand forgings of guaranteed minimum mechanical properties at many times exceeding AMS and Federal specifications.¹ Improved casting techniques developed by Kaiser Aluminum result in a high degree of forging stock soundness pre-

suiting the improved properties. These techniques include new deposing and metal handling methods at the detail stage. Ingers are consistently free of gas porosity and statistically free from inclusions. All Kaiser Aluminum hand forgings meet or exceed established industry standards for structure soundness.

New—new "Special Product" group offers highest property values and quality available in the industry today!

By applying new forging techniques to the improved quality Kaiser Aluminum forging stock a new group of hand forgings—called "Special Product"—has been developed.

"Special Product" hand forgings have guaranteed minimum mechanical properties significantly higher than the accepted Kaiser Aluminum "Standard" group. Of special interest to aircraft designers are the superior short transverse elongation values for all classes of this product in both 3014-T6 and 7075-T6 alloys. By offering hand forgings of this new, high quality, Kaiser Aluminum has achieved a standard long needed but not previously available in the aircraft industry.

Kaiser Aluminum hand forgings are now available in sizes up to 1000 pounds in a wide variety of shapes, with gross flow direction as specified by the customer.

For complete information, contact any Kaiser Aluminum sales office listed in your telephone directory. Kaiser Aluminum & Chemical Sales, Inc., General Sales Office, Palo Alto, Calif., Chicago 11, Illinois; Executive Office, Kaiser Bldg., Oakland 12, California.

Send for informative folder listing complete specifications for Kaiser Aluminum standard and "Special Product" hand forgings.

For the new standard in hand forgings...

think of *Kaiser Aluminum*

KAISER ALUMINUM STANDARD HAND FORGINGS GUARANTEED MINIMUM MECHANICAL PROPERTIES FOR 3014-T6													SPECIAL PURPOSE ALUMINUM HAND FORGINGS GUARANTEED MINIMUM MECHANICAL PROPERTIES FOR 3014-T6												
Part	Tensile Strength, 100 PSi in 1/2 in.			Yield Strength, 100 PSi in 1/2 in.			Elongation in 2 in., %			Part	Tensile Strength, 100 PSi in 1/2 in.			Yield Strength, 100 PSi in 1/2 in.			Elongation in 2 in., %								
	Temp. in 1/2 in.	Temp. in 1/2 in.	Temp. in 1/2 in.	Temp. in 1/2 in.	Temp. in 1/2 in.	Temp. in 1/2 in.	Temp. in 1/2 in.	Temp. in 1/2 in.	Temp. in 1/2 in.		Temp. in 1/2 in.	Temp. in 1/2 in.	Temp. in 1/2 in.	Temp. in 1/2 in.	Temp. in 1/2 in.	Temp. in 1/2 in.	Temp. in 1/2 in.								
1. 1/2 in. and under Lengths to 3 times width	67	43	62	73	50	33	10.0	6.0	4.0	1. 1/2 in. and under Lengths to 3 times width	67	43	62	73	50	33	10.0	6.0	4.0						
2. 3/4 in. and under Lengths to 3 times width	67	43	62	73	50	33	10.0	6.0	4.0	2. 3/4 in. and under Lengths to 3 times width	67	43	62	73	50	33	10.0	6.0	4.0						
3. 1 in. and under Lengths to 3 times width	67	43	62	73	50	33	10.0	6.0	4.0	3. 1 in. and under Lengths to 3 times width	67	43	62	73	50	33	10.0	6.0	4.0						
4. Over 1 in. to 2 1/2 in. Lengths to 3 times width	67	43	62	73	50	33	10.0	6.0	4.0	4. Over 1 in. to 2 1/2 in. Lengths to 3 times width	67	43	62	73	50	33	10.0	6.0	4.0						
5. Over 2 1/2 to 3 1/2 in. Lengths to 3 times width	67	43	62	73	50	33	10.0	6.0	4.0	5. Over 2 1/2 to 3 1/2 in. Lengths to 3 times width	67	43	62	73	50	33	10.0	6.0	4.0						
6. Over 3 1/2 to 4 1/2 in. Lengths to 3 times width	67	43	62	73	50	33	10.0	6.0	4.0	6. Over 3 1/2 to 4 1/2 in. Lengths to 3 times width	67	43	62	73	50	33	10.0	6.0	4.0						
7. Over 4 1/2 to 5 1/2 in. Lengths to 3 times width	67	43	62	73	50	33	10.0	6.0	4.0	7. Over 4 1/2 to 5 1/2 in. Lengths to 3 times width	67	43	62	73	50	33	10.0	6.0	4.0						
8. Over 5 1/2 to 6 1/2 in. Lengths to 3 times width	67	43	62	73	50	33	10.0	6.0	4.0	8. Over 5 1/2 to 6 1/2 in. Lengths to 3 times width	67	43	62	73	50	33	10.0	6.0	4.0						
9. Over 6 1/2 to 7 1/2 in. Lengths to 3 times width	67	43	62	73	50	33	10.0	6.0	4.0	9. Over 6 1/2 to 7 1/2 in. Lengths to 3 times width	67	43	62	73	50	33	10.0	6.0	4.0						
10. Over 7 1/2 to 8 1/2 in. Lengths to 3 times width	67	43	62	73	50	33	10.0	6.0	4.0	10. Over 7 1/2 to 8 1/2 in. Lengths to 3 times width	67	43	62	73	50	33	10.0	6.0	4.0						
11. Over 8 1/2 to 9 1/2 in. Lengths to 3 times width	67	43	62	73	50	33	10.0	6.0	4.0	11. Over 8 1/2 to 9 1/2 in. Lengths to 3 times width	67	43	62	73	50	33	10.0	6.0	4.0						
12. Over 9 1/2 to 10 1/2 in. Lengths to 3 times width	67	43	62	73	50	33	10.0	6.0	4.0	12. Over 9 1/2 to 10 1/2 in. Lengths to 3 times width	67	43	62	73	50	33	10.0	6.0	4.0						
13. Over 10 1/2 to 11 1/2 in. Lengths to 3 times width	67	43	62	73	50	33	10.0	6.0	4.0	13. Over 10 1/2 to 11 1/2 in. Lengths to 3 times width	67	43	62	73	50	33	10.0	6.0	4.0						
14. Over 11 1/2 to 12 1/2 in. Lengths to 3 times width	67	43	62	73	50	33	10.0	6.0	4.0	14. Over 11 1/2 to 12 1/2 in. Lengths to 3 times width	67	43	62	73	50	33	10.0	6.0	4.0						
15. Over 12 1/2 to 13 1/2 in. Lengths to 3 times width	67	43	62	73	50	33	10.0	6.0	4.0	15. Over 12 1/2 to 13 1/2 in. Lengths to 3 times width	67	43	62	73	50	33	10.0	6.0	4.0						
16. Over 13 1/2 to 14 1/2 in. Lengths to 3 times width	67	43	62	73	50	33	10.0	6.0	4.0	16. Over 13 1/2 to 14 1/2 in. Lengths to 3 times width	67	43	62	73	50	33	10.0	6.0	4.0						
17. Over 14 1/2 to 15 1/2 in. Lengths to 3 times width	67	43	62	73	50	33	10.0	6.0	4.0	17. Over 14 1/2 to 15 1/2 in. Lengths to 3 times width	67	43	62	73	50	33	10.0	6.0	4.0						
18. Over 15 1/2 to 16 1/2 in. Lengths to 3 times width	67	43	62	73	50	33	10.0	6.0	4.0	18. Over 15 1/2 to 16 1/2 in. Lengths to 3 times width	67	43	62	73	50	33	10.0	6.0	4.0						
19. Over 16 1/2 to 17 1/2 in. Lengths to 3 times width	67	43	62	73	50	33	10.0	6.0	4.0	19. Over 16 1/2 to 17 1/2 in. Lengths to 3 times width	67	43	62	73	50	33	10.0	6.0	4.0						
20. Over 17 1/2 to 18 1/2 in. Lengths to 3 times width	67	43	62	73	50	33	10.0	6.0	4.0	20. Over 17 1/2 to 18 1/2 in. Lengths to 3 times width	67	43	62	73	50	33	10.0	6.0	4.0						
21. Over 18 1/2 to 19 1/2 in. Lengths to 3 times width	67	43	62	73	50	33	10.0	6.0	4.0	21. Over 18 1/2 to 19 1/2 in. Lengths to 3 times width	67	43	62	73	50	33	10.0	6.0	4.0						
22. Over 19 1/2 to 20 1/2 in. Lengths to 3 times width	67	43	62	73	50	33	10.0	6.0	4.0	22. Over 19 1/2 to 20 1/2 in. Lengths to 3 times width	67	43	62	73	50	33	10.0	6.0	4.0						
23. Over 20 1/2 to 21 1/2 in. Lengths to 3 times width	67	43	62	73	50	33	10.0	6.0	4.0	23. Over 20 1/2 to 21 1/2 in. Lengths to 3 times width	67	43	62	73	50	33	10.0	6.0	4.0						
24. Over 21 1/2 to 22 1/2 in. Lengths to 3 times width	67	43	62	73	50	33	10.0	6.0	4.0	24. Over 21 1/2 to 22 1/2 in. Lengths to 3 times width	67	43	62	73	50	33	10.0	6.0	4.0						
25. Over 22 1/2 to 23 1/2 in. Lengths to 3 times width	67	43	62	73	50	33	10.0	6.0	4.0	25. Over 22 1/2 to 23 1/2 in. Lengths to 3 times width	67	43	62	73	50	33	10.0	6.0	4.0						
26. Over 23 1/2 to 24 1/2 in. Lengths to 3 times width	67	43	62	73	50	33	10.0	6.0	4.0	26. Over 23 1/2 to 24 1/2 in. Lengths to 3 times width	67	43	62	73	50	33	10.0	6.0	4.0						
27. Over 24 1/2 to 25 1/2 in. Lengths to 3 times width	67	43	62	73	50	33	10.0	6.0	4.0	27. Over 24 1/2 to 25 1/2 in. Lengths to 3 times width	67	43	62	73	50	33	10.0	6.0	4.0						
28. Over 25 1/2 to 26 1/2 in. Lengths to 3 times width	67	43	62	73	50	33	10.0	6.0	4.0	28. Over 25 1/2 to 26 1/2 in. Lengths to 3 times width	67	43	62	73	50	33	10.0	6.0	4.0						
29. Over 26 1/2 to 27 1/2 in. Lengths to 3 times width	67	43	62	73	50	33	10.0	6.0	4.0	29. Over 26 1/2 to 27 1/2 in. Lengths to 3 times width	67	43	62	73	50	33	10.0	6.0	4.0						
30. Over 27 1/2 to 28 1/2 in. Lengths to 3 times width	67	43	62	73	50	33	10.0	6.0	4.0	30. Over 27 1/2 to 28 1/2 in. Lengths to 3 times width	67	43	62	73	50	33	10.0	6.0	4.0						
31. Over 28 1/2 to 29 1/2 in. Lengths to 3 times width	67	43	62	73	50	33	10.0	6.0	4.0	31. Over 28 1/2 to 29 1/2 in. Lengths to 3 times width	67	43	62	73	50	33	10.0	6.0	4.0						
32. Over 29 1/2 to 30 1/2 in. Lengths to 3 times width	67	43	62	73	50	33	10.0	6.0	4.0	32. Over 29 1/2 to 30 1/2 in. Lengths to 3 times width	67	43	62	73	50	33	10.0	6.0	4.0						
33. Over 30 1/2 to 31 1/2 in. Lengths to 3 times width	67	43	62	73	50	33	10.0	6.0	4.0	33. Over 30 1/2 to 31 1/2 in. Lengths to 3 times width	67	43	62	73	50	33	10.0	6.0	4.0						
34. Over 31 1/2 to 32 1/2 in. Lengths to 3 times width	67	43	62	73	50	33	10.0	6.0	4.0	34. Over 31 1/2 to 32 1/2 in. Lengths to 3 times width	67	43	62	73	50	33	10.0	6.0	4.0						
35. Over 32 1/2 to 33 1/2 in. Lengths to 3 times width	67	43	62	73	50	33	10.0	6.0	4.0	35. Over 32 1/2 to 33 1/2 in. Lengths to 3 times width	67	43	62	73	50	33	10.0	6.0	4.0						
36. Over 33 1/2 to 34 1/2 in. Lengths to 3 times width	67	43	62	73	50	33	10.0	6.0	4.0	36. Over 33 1/2 to 34 1/2 in. Lengths to 3 times width	67	43	62	73	50	33	10.0	6.0	4.0						
37. Over 34 1/2 to 35 1/2 in. Lengths to 3 times width	67	43	62	73	50	33	10.0	6.0	4.0	37. Over 34 1/2 to 35 1/2 in. Lengths to 3 times width	67	43	62	73	50	33	10.0	6.0	4.0						
38. Over 35 1/2 to 36 1/2 in. Lengths to 3 times width	67	43	62	73	50	33	10.0	6.0	4.0	38. Over 35 1/2 to 36 1/2 in. Lengths to 3 times width	67	43	62	73	50	33	10.0	6.0	4.0						
39. Over 36 1/2 to 37 1/2 in. Lengths to 3 times width	67	43	62	73	50	33	10.0	6.0	4.0	39. Over 36 1/2 to 37 1/2 in. Lengths to 3 times width	67	43	62	73	50	33	10.0	6.0	4.0						
40. Over 37 1/2 to 38 1/2 in. Lengths to 3 times width	67	43	62	73	50	33	10.0	6.0	4.0	40. Over 37 1/2 to 38 1/2 in. Lengths to 3 times width	67	43	62	73	50	33	10.0	6.0	4.0						
41. Over 38 1/2 to 39 1/2 in. Lengths to 3 times width	67	43	62	73	50	33	10.0	6.0	4.0	41. Over 38 1/2 to 39 1/2 in. Lengths to 3 times width	67	43	62	73	50	33	10.0	6.0	4.0						
42. Over 39 1/2 to 40 1/2 in. Lengths to 3 times width	67	43	62	73	50	33	10.0	6.0	4.0	42. Over 39 1/2 to 40 1/2 in. Lengths to 3 times width	67	43	62	73	50	33	10.0	6.0	4.0						
43. Over 40 1/2 to 41 1/2 in. Lengths to 3 times width	67	43	62	73	50	33	10.0	6.0	4.0	43. Over 40 1/2 to 41 1/2 in. Lengths to 3 times width	67	43	62	73	50	33	10.0	6.0	4.0						
44. Over 41 1/2 to 42 1/2 in. Lengths to 3 times width	67	43	62	73	50	33	10.0	6.0	4.0	44. Over 41 1/2 to 42 1/2 in. Lengths to 3 times width	67	43	62	73	50	33	10.0	6.0	4.0						
45. Over 42 1/2 to 43 1/2 in. Lengths to 3 times width	67	43	62	73	50	33	10.0	6.0	4.0	45. Over 42 1/2 to 43 1/2 in. Lengths to 3 times width	67	43	62	73	50	33	10.0	6.0	4.0						
46. Over 43 1/2 to 44 1/2 in. Lengths to 3 times width	67	43	62	73	50	33	10.0	6.0	4.0	46. Over 43 1/2 to 44 1/2 in. Lengths to 3 times width	67	43	62	73	50	33	10.0	6.0	4.0						
47. Over 44 1/2 to 45 1/2 in. Lengths to 3 times width	67	43	62	73	50	33	10.0	6.0	4.0	47. Over 44 1/2 to 45 1/2 in. Lengths to 3 times width	67	43	62	73	50	33	10.0	6.0	4.0						
48. Over 45 1/2 to 46 1/2 in. Lengths to 3 times width	67	43	62	73	50	33	10.0	6.0	4.0	48. Over 45 1/2 to 46 1/2 in. Lengths to 3 times width	67	43	62	73	50	33	10.0	6.0	4.0						
49. Over 46 1/2 to 47 1/2 in. Lengths to 3 times width	67	43	62	73	50	33	10.0	6.0	4.0	49. Over 46 1/2 to 47 1/2 in. Lengths to 3 times width	67	43	62	73	50	33	10.0	6.0	4.0						
50. Over 47 1/2 to 48 1/2 in. Lengths to 3 times width	67	43	62	73	50	33	10.0	6.0	4.0	50. Over 47 1/2 to 48 1/2 in. Lengths to 3 times width	67	43	62	73	50	33	10.0	6.0	4.0						
51. Over 48 1/2 to 49 1/2 in. Lengths to 3 times width	67	43	62	73	50	33	10.0	6.0	4.0	51. Over 48 1/2 to 49 1/2 in. Lengths to 3 times width	67	43	62	73	50	33	10.0	6.0	4.0						
52. Over 49 1/2 to 50 1/2 in. Lengths to 3 times width	67	43	62	73	50	33	10.0	6.0	4.0	52. Over 49 1/2 to 50 1/2 in. Lengths to 3 times width	67	43	62	73	50	33	10.0	6.0	4.0						
53. Over 50 1/2 to 51 1/2 in. Lengths to 3 times width	67	43	62	73	50	33	10.0	6.0	4.0	53. Over 50 1/2 to 51 1/2 in. Lengths to 3 times width	67	43	62	73	50	33	10.0	6.0	4.0						
54. Over 51 1/2 to 52 1/2 in. Lengths to 3 times width	67	43	62	73	50	33	10.0	6.0	4.0	54. Over 51 1/2 to 52 1/2 in. Lengths to 3 times width	67	43	62	73	50	33	10.0	6.0	4.0						
55. Over 52 1/2 to 53 1/2 in. Lengths to 3 times width	67	43	62	73	50	33	10.0	6.0	4.0	55. Over 52 1/2 to 53 1/2 in. Lengths to 3 times width	67	43	62	73	50	33	10.0	6.0	4.0						
56. Over 53 1/2 to 54 1/2 in. Lengths to 3 times width	67	43	62	73	50	33	10.0	6.0	4.0	56. Over 53 1/2 to 54 1/2 in. Lengths to 3 times width	67	43	62	73	50	33	10.0	6.0	4.0						
57. Over 54 1/2 to 55 1/2 in. Lengths to 3 times width	67	43	62	73	50	33	10.0	6.0	4.0	57. Over 54 1/2 to 55 1/2 in. Lengths to 3 times width	67	43	62	73	50	33	10.0	6.0	4.0						
58. Over 55 1/2 to 56 1/2 in. Lengths to 3 times width	67	43	62	73	50	33	10.0	6.0	4.0	58. Over 55 1/2 to 56 1/2 in. Lengths to 3 times width	67	43													

Engineering Design Research Development

Broad challenge, career opportunity for
structural engineers

This opportunity concerns no narrow field of endeavor.

For structural engineers it is an engaging challenge which is both continuing and unlimited in scope.

It deals with work in a variety of long-range projects under way at Goodyear Aircraft, dealing with air weapons, jet aircraft, missiles, ships, helicopters—along with boating, farm implements and radar structures.

It concerns new concepts and configurations.

It involves the utilization of a host of

materials—new laminated plastics, new alloys, new structural sandwiches.

It calls for fresh skills, the exploration of new avenues of approach.

For the creative professional, in any of a wide variety of engineering fields, it foretells a rewarding and satisfying career.

APPLICATIONS INVITED. Forms on request, resumes appraised and treated confidentially. Address: C. G. Jozsa, Personnel Department, Goodyear Aircraft Corporation, Akron 18, Ohio. Plans in Akron and Litchfield Park, Arizona.

They're doing big things at

GOODYEAR AIRCRAFT

THE TEAM TO TEAM WITH IN AERONAUTICS

CAB Reports Accident Causes In Braniff, PAA, NWA Crashes

Washington—Civil Aeronautics Board has reported on its investigations of Pan American World Airways and Braniff Airways accidents and issued a record report as a 1952 Northwest Airlines crash.

The Pan American crash on the ditching of a Boeing Stratoliner near Portland, Ore., last March and the Braniff accident involved the crash at Conway 340 of Chicago's Midway Airport on Feb. 1.

The Northwest accident report is a revision of findings in the crash of a Northwest DC-4 near Sandpoint, Idaho, Colville on Jan. 1951.

The CAB found that:

- The Braniff Conquest probably crashed because of a loss of visual reference during the final phase of the approach.
- The Pan American accident was probably caused by the failure of the No. three propeller, causing the loss of the No. three engine.
- The Northwest DC-4 accident was probably the result of new gas turbine difficulty in connection with icing conditions as a power loss, making the aircraft incapable of maintaining altitude.

Conquest Crash Sigh

The Braniff Conquest was completing a Dallas-Chicago flight via Oklahoma City, Wichita and Kansas City. During an instrument approach to Midway, it struck on 18 foot poles and the aircraft broke apart and 1,500 ft from the runway threshold lights. The Conquest crashed through the airport boundary fence, burst into and caught fire. Of four passengers and a crew of three, the pilot, the captain and 20 passengers were fatally injured.

The sign struck by the Braniff aircraft was about 34 ft. below and 112 ft. to the left of the ILS glide path and location course aerobically.

The approach controller and that the approach executed by the Conquest was very good up to the point he saw the aircraft on a half mile out. Past that point, the airplane descended rapidly, at least 2,000 ft. per minute, and departed from the glide path.

The CAB stated that the pilot made visual contact, then lost it again as he dove low that had caused the accident. It concluded that the pilot had a momentary disorientation during the transition from visual reference back to instruments. During that period it is believed the airplane descended rapidly before corrective action could be taken.

The Pan American accident involves an engine separation, a rotating propeller and loss of the Boeing Stratoliner, and on some debris. The aircraft was 41 minutes out of Portland, Ore., on a Seattle-bound flight via Honolulu when a vibration occurred and the No. three engine tore free and dropped from the aircraft.

Engine Dropped

The Stratoliner became temporarily uncontrollable and lost altitude rapidly. The pilots regained control, but attempts to get rated power on the remaining three engines were futile, and the airplane continued to descend until it crashed in a field on its main route after the engine was lost.

All 35 passengers and the crew of eight were uninjured, but four of them lost their lives subsequently through engine or propeller failure. The aircraft sank in shallow water about twenty minutes after it was ditched.

The CAB finds the primary cause of the accident was loss of control and an inability to maintain altitude because of the failure of the No. three propeller and engine. It is estimated that the propeller threw a blade, disintegrating itself and causing the engine loss. The accident is similar to two previous ones with the Boeing which have been traced to the hollow blade. Honolulu Standard propeller in use. A program is currently under way to develop a solid aluminum propeller for the Stratoliner.

The CAB pointed out that the aircraft was ditched under easily said circumstances, and that there should have been little difficulty in transferring passengers and crew to life rafts. The loss of life was attributed to ditching away from the burning airplane, making it necessary for the occupants to swim to them. This led to the deaths of a passenger and two crew members who could not reach them. The CAB passed this method of unduly delayed passengers and crew members.

Since the accident, steps have been taken to improve the design of the blades and tighter inspection of the hollow blades for corrosion or fatigue which might lead to propeller failure.

New Evidence

The Northwest DC-4 accident report was issued as a revision made on the basis of new evidence.

The accident occurred as a Yakovlev aircraft flew over the DC-4 developed engine trouble and tried to make an emergency landing at the Sandpoint, British Columbia, airport. After touching down, the aircraft attempted a

three-engine takeoff and go-around. It cleared a fence at the end of the runway, but could not maintain altitude and crashed in the Hecate Strait, less than a mile offshore.

More Gear Malfunction

All or nearly all of the 46 passengers and three crew members evacuated the aircraft, but due to the increasing temperature of the air and water, only seven passengers survived when help arrived about an hour and a half after the crash.

Subsequent examination of fragments of the DC-4 and at the same time, the CAB has concluded that the CAB is not to believe that malfunctioning of the nose gear mechanism was the cause of the crash of the aircraft which was caused by the loss of the main wheel doors and led to landing. Such an occurrence could have caused deterioration of flight performance.

The Board concludes that the accident was probably caused by such a nose gear malfunction associated with an engine failure or loss which made the DC-4 incapable of maintaining flight.

**Death Penalty Urged
For Plane Sabotage**

Deaths of 46 persons in the crash of a scheduled United Air Lines' aircraft near Denver, Colo., has spurred a move for the enactment of legislation making plane sabotage resulting in loss of human life a capital offense.

Sen. Warren Magnuson (D-Wash.), chairman of the Senate Committee on Commerce and Finance, said the CAB report has led him to believe that the CAB is not to believe that malfunctioning of the nose gear mechanism was the cause of the crash of the aircraft which was caused by the loss of the main wheel doors and led to landing. Such an occurrence could have caused deterioration of flight performance.

Referring to the Colorado crash, Magnuson declared that "anyone who deliberately planned a wholesale taking of life... that airplane, certainly does not deserve less protection than a man who would see persons in cold blood."

Western Sets Record

Western Air Lines reports record traffic and income for the first nine months of 1955. Total mileage increased by 16% while passenger traffic rose 50%.

Net income for the period reported at \$1,679,756 (52.21 a share). Income for the nine-month period was \$1,877,134 (51.45 a share).



Don Fort, Vice President & General Counsel, Airline Division, Eastern Airlines, New York



Tom Hopper, Director of Passenger Affairs, Delta Air Lines, Atlanta, Ga.



Tom Hopper, Director of Passenger Affairs, Delta Air Lines, Atlanta, Ga.



Tom Hopper, Director of Passenger Affairs, Delta Air Lines, Atlanta, Ga.



Tom Hopper, Director of Passenger Affairs, Delta Air Lines, Atlanta, Ga.



Tom Hopper, Director of Passenger Affairs, Delta Air Lines, Atlanta, Ga.



Tom Hopper, Director of Passenger Affairs, Delta Air Lines, Atlanta, Ga.



Tom Hopper, Director of Passenger Affairs, Delta Air Lines, Atlanta, Ga.



Tom Hopper, Director of Passenger Affairs, Delta Air Lines, Atlanta, Ga.



Tom Hopper, Director of Passenger Affairs, Delta Air Lines, Atlanta, Ga.



Tom Hopper, Director of Passenger Affairs, Delta Air Lines, Atlanta, Ga.



Tom Hopper, Director of Passenger Affairs, Delta Air Lines, Atlanta, Ga.



Tom Hopper, Director of Passenger Affairs, Delta Air Lines, Atlanta, Ga.



Tom Hopper, Director of Passenger Affairs, Delta Air Lines, Atlanta, Ga.



Tom Hopper, Director of Passenger Affairs, Delta Air Lines, Atlanta, Ga.



Tom Hopper, Director of Passenger Affairs, Delta Air Lines, Atlanta, Ga.



Tom Hopper, Director of Passenger Affairs, Delta Air Lines, Atlanta, Ga.



Tom Hopper, Director of Passenger Affairs, Delta Air Lines, Atlanta, Ga.



Tom Hopper, Director of Passenger Affairs, Delta Air Lines, Atlanta, Ga.



Tom Hopper, Director of Passenger Affairs, Delta Air Lines, Atlanta, Ga.



Tom Hopper, Director of Passenger Affairs, Delta Air Lines, Atlanta, Ga.



Tom Hopper, Director of Passenger Affairs, Delta Air Lines, Atlanta, Ga.



Tom Hopper, Director of Passenger Affairs, Delta Air Lines, Atlanta, Ga.



Tom Hopper, Director of Passenger Affairs, Delta Air Lines, Atlanta, Ga.



Tom Hopper, Director of Passenger Affairs, Delta Air Lines, Atlanta, Ga.

AERO REGION Commander

NATION-WIDE SALES AND SERVICE

AERO REGION AND ENGINEERING COMPANY

TULSA AIRPORT • OKLAHOMA CITY • OKLAHOMA

CAB Orders

(Pac. 1114)

GRANTED

Leave to intervene in the Florida City Airfield investigation by the Airline Chamber of Commerce and the Chamber of Commerce of Columbia, Ga. Petition at the Lane County Chamber of Commerce, Fla., and the Southern Missouri Airport Authority, Mo., denied.

School and Western Airlines' application for its extension of its operations in the Northwest is refused by the Federal Aviation Commission. The extension is refused by Feb. 15, 1964, or until Western starts scheduled service, whichever occurs first, to allow added time to secure approval of foreign governments.

APPROVED

Refueling relationship between Trans World Airlines, Ralph S. Denson and Houston's Herby Corp.

Agreements involving Eastern Air Lines, Delta Air Lines and various other interests relating to passenger arrangements.

ORDERED

Suppression of a Trans World Airlines Los Angeles-Francisco secondary service, later extended to Feb. 30, 1964, to allow added time for investigation.

Order Air Lines to shut down any the Board should not set a temporary rule for the period ending Oct. 21, 1965, to allow for a new regulation set of 32, 14,040, or the first day.

Canadian Airlines to close down any the Board should not set a temporary rule for the period ending Oct. 21, 1965, to allow for a new regulation set of 32, 14,040, or the first day.

North Coast Airlines' suspension authority to operate foreign service between Dallas, Texas, and Chicago on Milwaukee and Green Bay, Wis., suspended.

DISMISSED

William W. Clark's application for operating authority, since the applicant doesn't wish to proceed further with the application at the present time.

American Airlines' application for a Seattle-Miami route, at the request of the applicant.

DENIED

Robert Andrews' application for installation of certain revenue arrangements pursuant to the Robert Andrews central office. Herring, Eugene, La., petition for installation authority to carry an express package delivery in the air freight terminal case.

Petition at Trans World Airlines for installation and purchase of Delta Air Lines and National Airlines for representation and clarification in the Florida State service center. Petition at Trans World Airlines, the City of New Orleans and the Chamber of Commerce of the New Orleans area for leave to intervene are granted.

Capital Re-Enters Newark

Capital Airlines will resume operations into and from Newark Airport on Thursdays after a suspension of almost four years.

On Jan. 14, 1964, New Orleans and San Francisco and Washington from New York. The airline left before operations into the airport on Feb. 4, 1964, but failed the service in January, 1962, after having been several of its planes in the Government for several years.

White House Approves Less Route Authority

The White House will go along with legislation reducing its authority over foreign or domestic routes and changing its jurisdiction over various routes according to the Senate Commerce Committee.

A measure sponsored by Sen. Magnus (D-Wash.), Chairman of the Senate Commerce Committee.

A measure sponsored by Sen. Magnus would restrict the President's review of foreign route cases to aspects involving international relations or defense considerations. It would clarify that the President has no veto authority over domestic routes.

Magnus maintains that this is only a "clarification" of the original intent of the 1938 Civil Aeronautics Act.

According to the measure, to gain the income in the coming session of Congress, he declared: "I have the informal approval of the people down at the White House. I can see why they want to get the question off their minds and it was never intended under the 1935 act."

Civil Aeronautics Board has approved the measure, income at present, earlier this year.

Commerce and State Departments approved it.

New Viscount Service

Capital Airlines will introduce the Viscount turboprop in the New York-Chicago route market Dec. 1.

Initial schedule for Capital's new Viscount service calls for two round trips daily between New York and Chicago with an intermediate stop at Pittsburgh.

Weekend flights will leave New York at 8 a.m. and 4 p.m. with flights leaving Chicago enroute at 11:45 a.m. and 5:45 p.m.

Centerline Lighting Installed at Idlewild

Washington-Civil Aeronautics Administration's installation of a centerline approach lighting system at New York's Idlewild International Airport was completed last month, less than a year after the destruction of a sloped-roof system by the LAA DC-8 crash on Dec. 31, 1964.

Lighting system is Type A system, which means there is an intermediate designated. Eventually there is to be an addition to suspended lighting system, which was recently installed at airports where low visibility conditions frequently occur.

Since the centerline system was adopted in 1952, there have been eight CAA-approved installations completed and there were no new under way. The total cost is \$1.5 million.

The first system, which is a Type A, was installed at Newark Airport in November 1962. Other Type A lighting systems have been installed at Fort Worth, Dallas and San Francisco.

Type B systems, which have an intermediate designated, are in operation at Pittsburgh, Knoxville and Salt Lake City.

Three additional centerline systems are scheduled for operation at Washington, Los Angeles and Chicago. Two of these installations are in addition to sloped-roof systems already in operation at Washington and Los Angeles. One other sloped-roof system is in operation at Arcadia, Calif., in addition to the sloped-roof installation which was destroyed at Idlewild. CAA demonstrated the sloped-roof system installed at Idlewild.

Shortlines

Herring-Claire Air Transport has resumed round-trip service between London and Cleveland in two round trips monthly with Viking equipment.

Meteor Air Transport has 1,043,499 tons miles of cargo traffic in the first quarter of this year. Meteor has leased two C-46 aircraft from Trans-Continental Airlines, bringing its total fleet to seven C-46s.

School and Western Airlines has signed cargo rate agreements with National Airlines and Viking Airlines.

United Air Lines will resume service to Santa Barbara, Monterey and Eureka, Calif., Dec. 5 with Constellation equipment.

THE FASTEST FLY WITH THE J-57

In the Air Force, J-57 turbojet engines power the fastest fighters—including the holder of the official world speed record. In the Navy, J-57s power the fastest carrier-based aircraft, fighters capable of supersonic speeds in level flight. The mighty B-52, new strength of the Strategic Air Command and the fastest bomber, is powered by J-57 engines, as is the fastest transport now flying, the 707 prototype jet tanker-transport.

In all of these powerful aircraft, and in many

others, Pratt & Whitney Aircraft's J-57 advanced turbojet engine has been chosen to meet the exacting requirements of high thrust rating, reliability and efficiency.

The leading land-based and carrier-based fighters, the new mainstay of the heavy bomber fleet, and the jet transports are all designed to take advantage of the performance of the J-57 engine. Pratt & Whitney Aircraft's J-57 is contributing to make its vital contribution to American air strength.

1. SUPersonic RECORD HOLDER—The North American F-100C holds the official world speed record, 825.141 miles per hour. Already in operation due to the USAF's Tactical Air Command, the F-100C Super Sabre can deliver an atom bomb at high speed.

2. NIGHTST OF THE BOMBER—The Douglas B-52 Superfortress was eight J-57 engines being in push under the wings. Slow in start of the Strategic Air Command, the B-52 can be refueled in flight to extend its range as needed. Speed is over 600 m.p.h., ceiling over 50,000 feet.

3. JET TANKER-TRANSPORT—Boeing's 707 prototype, with four J-57s, is the fastest transport and the first of a new family of advanced jet aircraft. The Air Force has ordered production of a tanker-transport version, the KC-135. As a commercial transport, the aircraft could carry from 60 to 120 passengers, seating in the 500 m.p.h. range.

4-5. FASTEST NAVY FIGHTERS—The Douglas F4D Skyray, left, with delta wing, set a 559.4 m.p.h. record on a 1000 kilometer straightaway run. The new Chance Vought XF9D-1 Corsair, right, with swept wing, features a trim, lightweight airframe and unobstructed design. Both are equipped with afterburners, and can exceed the speed of sound in level flight.



THE POWERFUL J-57—Pratt & Whitney Aircraft's efficient J-57 provides more than 10,000 pounds of thrust. Afterburners increase the turbo thrust greatly for short periods of operation. The engine delivers rapid acceleration and is economical of fuel, adding to the high performance of the world's fastest, most powerful combat aircraft.



ONE OF THE DIVISIONS OF
PRATT & WHITNEY CORPORATION

Pratt & Whitney Aircraft

MAIN OFFICE AND PLANT, EAST HARTFORD, CONNECTICUT • BRANCH PLANTS: NORTH HAVEN, BOSTON/INDIAN, MERIDEN

In Canada: Canadian Pratt & Whitney Aircraft Co. Ltd.





YOUR BEST SOURCE FOR ...



INVERTERS



**AC-DC
GENERATORS**



**VOLTAGE
REGULATORS**



**FRACTIONAL H. P.
DC MOTORS**



**SPECIAL-PURPOSE
ELECTRON TUBES**



DYNAMOTORS

When it comes to special-purpose electron tubes, or dedicated power equipment of the types shown above, you can be sure of getting top quality from Bendix Red Bank. That's because we offer the unbeatable combination of skillful design and expert engineering plus quality control over every step of manufacture. Our super-modern facilities and highly experienced technical people are always at your disposal. Call on

us any time for recommendations. RED BANK DIVISION, BENDIX AVIATION CORPORATION, EASTOWN, NEW JERSEY.

Red Bank Sales and Service: 117 E. Franklin Ave., Newark, N.J.
Bendix Aviation Corporation: 4000 W. 4th St., Kansas City, Mo.
Bendix Sales: Bendix International Division, 300 S. 4th St., New York 13, N.Y.



ADVERTISERS IN THIS ISSUE

AVIATION WEEK—NOVEMBER 26, 1955

ALCO ELECTRIC & ENGINEERING COMPANY	120	ALCO ELECTRIC & ENGINEERING COMPANY	120
ALCO ELECTRIC & ENGINEERING COMPANY	120	ALCO ELECTRIC & ENGINEERING COMPANY	120
ALCO ELECTRIC & ENGINEERING COMPANY	120	ALCO ELECTRIC & ENGINEERING COMPANY	120
ALCO ELECTRIC & ENGINEERING COMPANY	120	ALCO ELECTRIC & ENGINEERING COMPANY	120
ALCO ELECTRIC & ENGINEERING COMPANY	120	ALCO ELECTRIC & ENGINEERING COMPANY	120
ALCO ELECTRIC & ENGINEERING COMPANY	120	ALCO ELECTRIC & ENGINEERING COMPANY	120
ALCO ELECTRIC & ENGINEERING COMPANY	120	ALCO ELECTRIC & ENGINEERING COMPANY	120
ALCO ELECTRIC & ENGINEERING COMPANY	120	ALCO ELECTRIC & ENGINEERING COMPANY	120
ALCO ELECTRIC & ENGINEERING COMPANY	120	ALCO ELECTRIC & ENGINEERING COMPANY	120
ALCO ELECTRIC & ENGINEERING COMPANY	120	ALCO ELECTRIC & ENGINEERING COMPANY	120

CLASSIFIED ADVERTISING

EMPLOYMENT OPPORTUNITIES	120-121
SPECIAL SERVICES TO THE INDUSTRY	120-121
ADVERTISING OPPORTUNITIES	120-121
TECHNICAL SERVICES	120-121
PRODUCTS	120-121



Another serving tray... another Skylark product by SKYLARK



PRECISION SHIRT METAL & MACHINE PARTS
COMPLETE ENGINEERING SERVICE
U.S. AIRCRAFT SPOT WELDING & OTHER
WELDING SERVICES
ELECTRONIC PARTS AND EQUIPMENT
AIRCRAFT ENGINE REPAIRS
QUALITY AND COMMODITY EQUIPMENT
GROUND SERVICE EQUIPMENT



**Complete Up-to-Date
Information on
United States Airports**

THE NEW 1955-56 AIRPORT DIRECTORY AND BUSINESS FLYERS' GUIDE

It's just off the press. It lists more than 6,800 airports... it shows latitude and longitude, number and types of runways, rights and mortgages, obstructions, radio and weather facilities, repair services, hangars, restaurants—even bus and taxi services. Among many other valuable features are tips on weather and navigation, a map of the CAA region, and data on running state government taxes. A free United States Planning Chart goes with every copy.

The price is \$4.00 per copy. Send your check or money order to:

AIRPORT DIRECTORY MCGRAW-HILL PUBLISHING CO.
212 W. 42nd St., New York 36, N.Y.

An Integral Part of the Arsenal

Naval aviation is emerging from the technical and tactical doldrums in which it has languished since the end of World War II. Lack of a substantial research and development program in the post-Korean war years doomed naval aviation to fight the Korean war with technically obsolete equipment, mostly World War II surplus piston-powered fighters and attack planes.

Even the first crop of subsonic Navy jet fighters was too slow to match the combat pace of the neighborhood USAF F-4 and the Russian MiG-17. Navy had to turn to a carrier-based version of the F-4 to bolster its first line of aerial defense.

During the Korean crisis, however, the spigot of research and development funds was opened wider. Now after almost five years of accelerated technical development effort and some expensive failures, interesting results are appearing that will assure the continuance of naval aviation as an integral part of the American arsenal.

Nuclear Revolution

Nuclear power and nuclear weapons have wrought the biggest change in naval armament. Nuclear powered submarines and aircraft carriers will provide unprecedented speed and range for floating golden mobile and bomber launching platforms. Nuclear weapons packaged to fit the waistline of a missile and the bomb casing of fighter-type aircraft provide naval armament with unprecedented destructive power.

James H. Smith, Assistant Secretary of the Navy for Air, in a recent speech mentioned "the introduction of warheads whose yields are measured in megatons," indicating that faster type nuclear bombs have been reduced to packages small enough for use soon in carrier based aircraft. Nuclear power for aircraft is a little further in the future but there is no doubt that a nuclear-powered airplane armed with atomium fusion bombs will be a Navy weapon in the foreseeable future.

Secretary Smith also paints a picture of the Navy's mobile nuclear arsenal face with the Forrestal super carrier as its nucleus augmented by missile launching cruisers for defense and missile launching submarines for offense.

Higher Speeds

The planes of the Forrestal class carrier will have supersonic speeds both for defense fighters such as the Grumman Tiger and the Vought Corsair and for attack planes carrying lasers or fusion-type bombs such as the Douglas Skyhawk and Skywarrior and the McDonnell F-4H. Secretary Smith also forecast speeds of over 3,000 mph for the next generation of Navy fighters.

The principal advantages of the Navy's mobile nuclear arsenal force, according to Secretary Smith, are:

- It is a moving target and vulnerable to attack by ballistic missiles and requires that a large portion of an enemy's aerospace resources be diverted to locate and attack the task force.
- It can use water for decontamination in event of a nuclear attack and as a shielding device for its nuclear powerplants.
- It is not dependent on foreign bases nor will it endanger large populated land areas with radioactive fall out from a nuclear attack on air ships and planes.

The jet-powered airplane with speeds equal to its land-based contemporaries and capable of affording the self-sealing character of water remains has already made its appearance as a naval weapon in the Marina P-61 SeaMaster. Combined with submarine launchers, this can be a weapon of almost unlimited range and radius. Its defense counterpart, the Lockheed Lightning, has also appeared in prototype form in the Convair F-102 but will require considerable more development before it becomes a useful weapon.

Bolder Attitude

Even more encouraging evidence that the Navy is taking a bolder and more aggressive attitude toward extending its technological frontiers:

"In our constant battle to compress the time factor between the birth of an idea and the delivery in quantity of a combat weapon, certain calculated risks must be taken," said Secretary Smith. "Our exploration of an unknown area must not be deterred by the fear of making a mistake."

Failure to bring a weapon to a usable stage due to incorrect decisions based on honest errors is polyanous as looked at twice to appear through hindsight as negligent or as an indication of a total disregard for the taxpayer dollar. I assure you that it is the Navy where research and development funds must provide weapons and firing platforms available for use above the surface, on the surface and below the surface, we must carefully associate all expenditures.

"It must be understood, however, that research and development money is not intended for useless experiments. It is intended for investment in high risk ventures selected by military and civilian experts."

With this type of courageous and forthright approach to the uncertainties and increasingly urgent technical development problems facing naval aviation, there appears to be little doubt that it will retain its place as an integral part of our arsenal.

—Robert Hots

Building, not avoiding, the difficult relays

one phase of LEACH leadership

Some firms shun urgent products, deal only with standard units... the ones with no design challenge. At Leach Relay Division, on the other hand, we're interested in the unusual.

Leach is particularly well equipped to handle your complex relay problems, for we're big enough, old enough to have developed the industry's largest reservoir of relay-design experience... yet so flexible that we can move rapidly on special requirements. Here, for example are three long standing overall problems and the Leach relay... each a complete, hermetically sealed package... that solved them.



ON THE GROUND... correctly phased ground power can cause serious damage.

LEACH'S ANSWER... 4000 Phase Sequence Relay, which includes a 2-phase stall torque motor and control switches. Unless the predetermined phase sequence is applied at normal voltage, the relay will not allow the main contactor to close.

IN THE AIR... relays must operate from low-level voltages (e.g., thermocouples, microtransducer tubes, small flip rings) and shock resistance is vital.

LEACH'S ANSWER... 5000, combinations of relay and magnetic amplifier, is sensitive to 1 millivolt, is immune to shocks as great as 50 g. In addition it is compact and light.

ON COURSE... gyro compasses drift if voltage input drops, but the built-in 200V they generate holds normal relays closed for 15-30 minutes.

LEACH'S ANSWER... 9007 Chemo-Differential Relay, a combination of magnetic amplifier, oscillator, and relay which warns the pilot of any drop as small as 5 volts.

LEACH

CORPORATION | LEACH RELAY DIVISION

LEACH RELAY DIVISION
JIM PALMER DIVISION

2515 ARAGON BOULEVARD LOS ANGELES 3, CALIFORNIA

SERVING INDUSTRY IN THE LABORATORY... ON THE PLANT... ON THE GROUND... ON THE AIR

BUILDING BLOCK

Sub-Systems

...in support of the Weapons System Concept

Servomechanisms' philosophy of reducing complex electronic requirements into functionally packaged "building blocks" complements the U.S. Air Force's Weapons System Concept—"Give us a weapon—ready to go!" Our consistent and proven ability to satisfy the exacting demands of today's highly complex military aircraft and missiles have established Servomechanisms as one of the foremost designers and producers of electronic and electromechanical sub-systems for flight control and instrumentation. Because of our advanced engineering skills and techniques in reducing complex requirements into "building block" systems, airframe manufacturers know they can rely on Servomechanisms to help them solve their most complicated sub-system problems.

Complete interchangeability and plug-out, plug-in servicing reduces down time to a minimum, insures maximum reliability and helps give the Air Force a weapon—"ready to go!"

Consider the outstanding features of "building block" sub-systems when analyzing your overall system requirements, ... specify Servomechanisms, Inc.

The Mechatron Master Data Computer

This typical sub-system provides a single coordinated source for input data required by the various control and instrumentation systems of an aircraft. This equipment is being produced in different versions, tailored to meet the requirements of specific aircraft. The particular arrangement of this equipment is dictated by the requirements of the problem. A wide variety of "building blocks" is available. These proven components are selected and plugged into a common chassis which forms a sub-system producing the required data for a particular application.



True airspeed positioner



Dynamic pressure positioner



Mach positioner



Jump angle positioner



Angle of attack positioner



Air density positioner

SERVOMECHANISMS
INC.



Eastern Division
Post and Stewart Avenues Westbury, New York

Western Division
12500 Aviation Boulevard Hawthorne, California

Components Division
400 Main Street Westbury, New York